US009447953B2

(12) **United States Patent**
**Lawlor**

(10) **Patent No.: US 9,447,953 B2**
(45) **Date of Patent: Sep. 20, 2016**

(54) **ADJUSTABLE LUMINAIRE**

(71) Applicant: **Generation Brands LLC**, Skokie, IL (US)

(72) Inventor: **Michael Lawlor**, Chicago, IL (US)

(73) Assignee: **GENERATION BRANDS LLC**, Skokie, IL (US)

( * ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 29 days.

(21) Appl. No.: **14/291,433**

(22) Filed: **May 30, 2014**

(65) **Prior Publication Data**

US 2015/0345761 A1 Dec. 3, 2015

(51) **Int. Cl.**

| | |
|---|---|
| ***F21V 15/01*** | (2006.01) |
| ***F21V 19/00*** | (2006.01) |
| ***F21V 21/04*** | (2006.01) |
| ***F21V 21/14*** | (2006.01) |
| *F21V 29/70* | (2015.01) |
| *F21S 8/02* | (2006.01) |
| *F21V 19/04* | (2006.01) |
| *F21Y 101/02* | (2006.01) |

(52) **U.S. Cl.**

CPC ..... ***F21V 21/14*** (2013.01); *F21S 8/024* (2013.01); *F21S 8/026* (2013.01); *F21V 19/001* (2013.01); *F21V 19/04* (2013.01); *F21V 29/70* (2015.01); *F21Y 2101/02* (2013.01)

(58) **Field of Classification Search**

CPC ..... F21V 21/22; F21V 21/14; F21V 21/04; F21V 21/02

See application file for complete search history.

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*Primary Examiner* — Renee Chavez

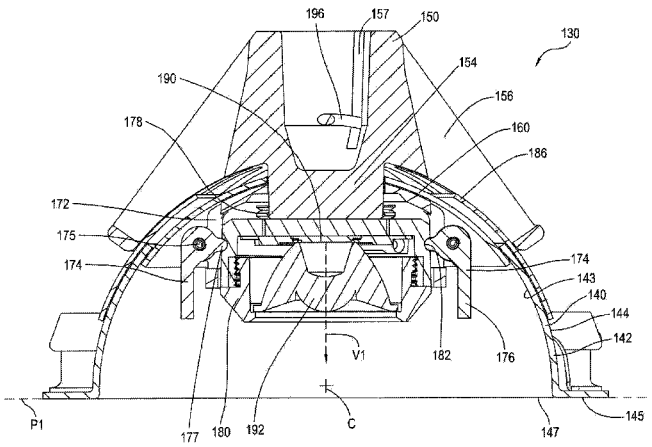
*Assistant Examiner* — Eric T Eide

(74) *Attorney, Agent, or Firm* — Marshall, Gerstein & Borun LLP; Randall G. Rueth

(57) **ABSTRACT**

Disclosed is a light fixture that includes a main body element that approximates a hollow spherical segment, a lamp assembly that includes a light source, an inner element, an outer element, wherein the light source, the inner element and the outer element are coupled together with the main body element positioned between the outer element and the inner element, and a central portion that extends through the main body element and couples the inner element to the outer element, wherein the lamp assembly is selectively movable relative to the main body element to alter a relative position and an angular orientation of the light source relative to the bottom opening without any portion of the lamp assembly extending blow the main body element.

**20 Claims, 33 Drawing Sheets**



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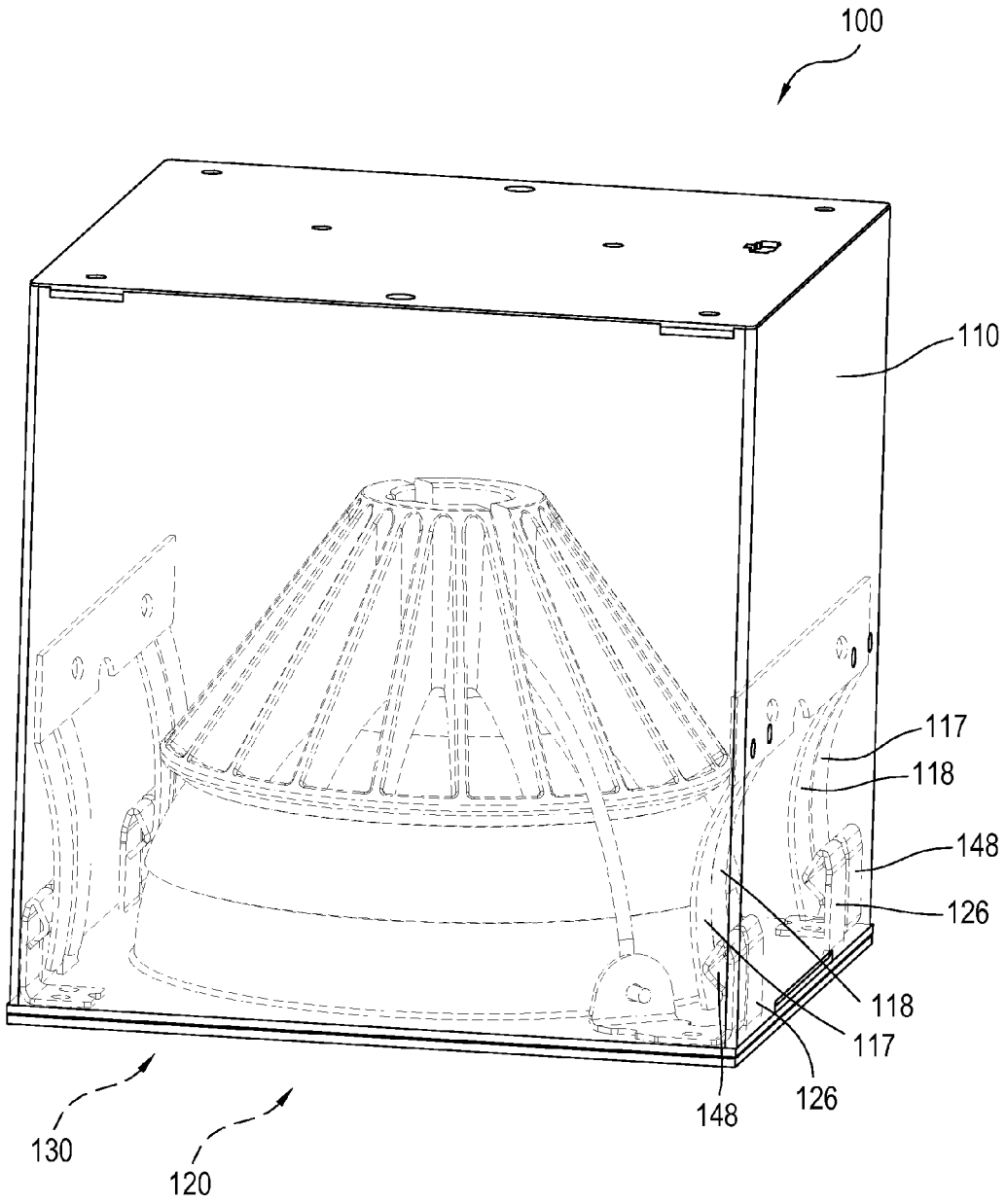


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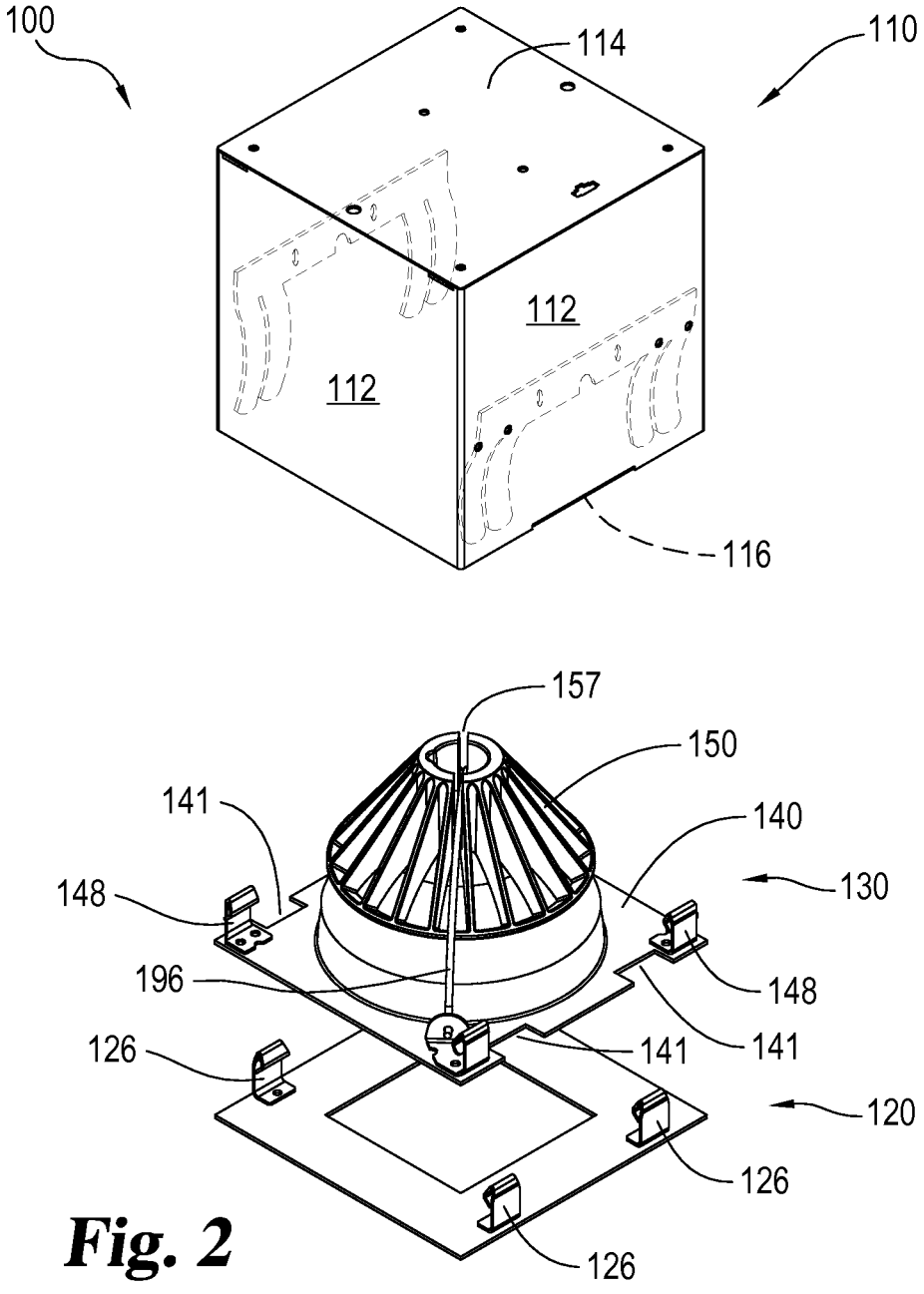
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*Fig. 2*

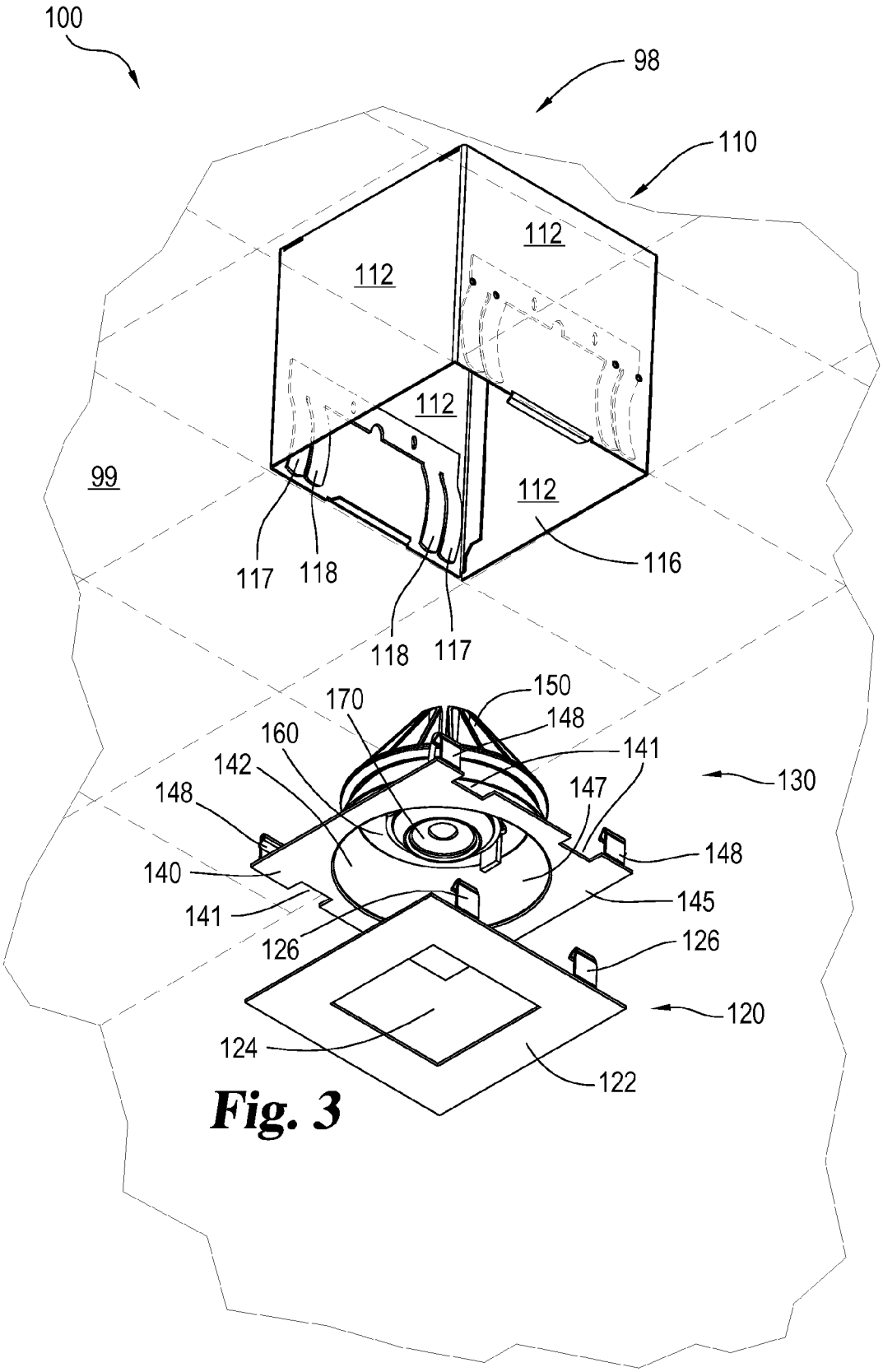
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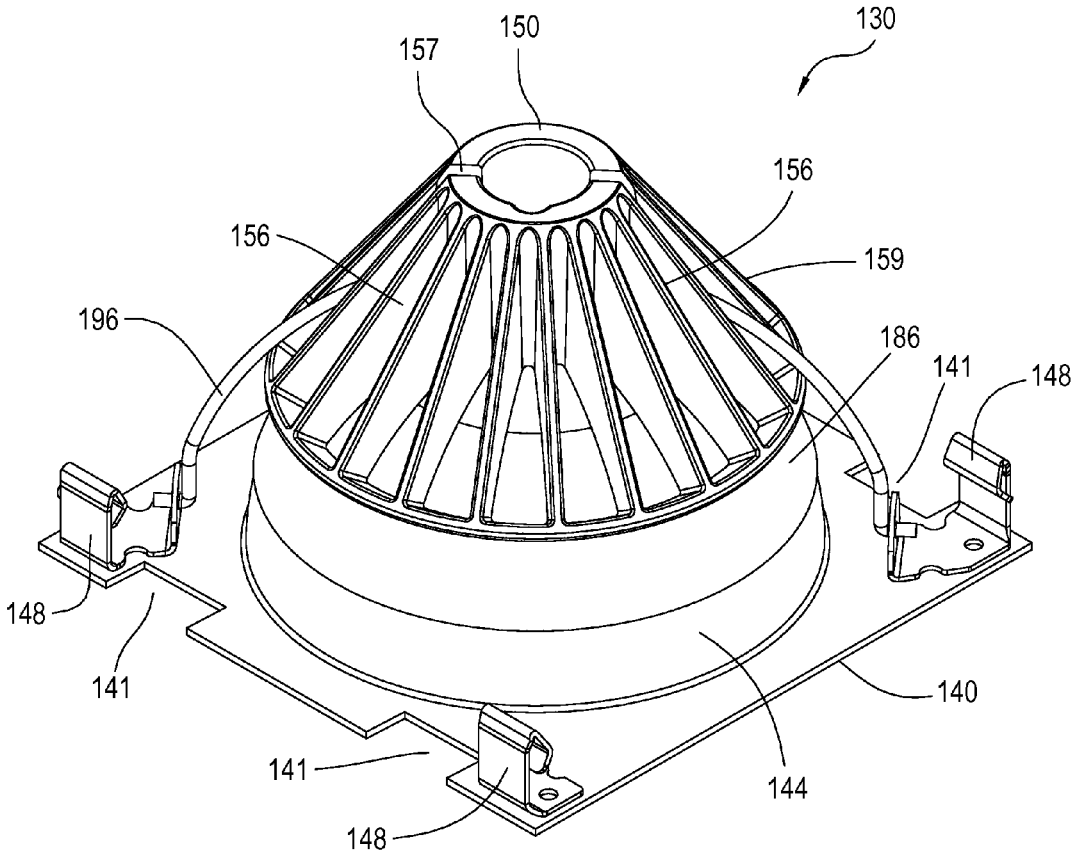
*Fig. 3*

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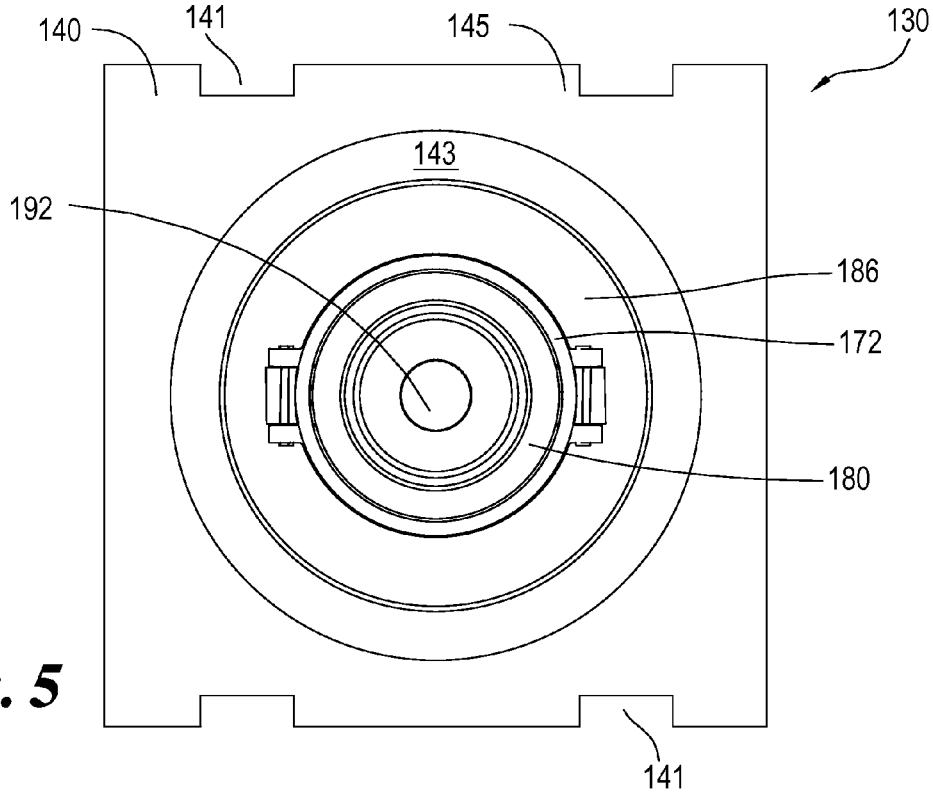
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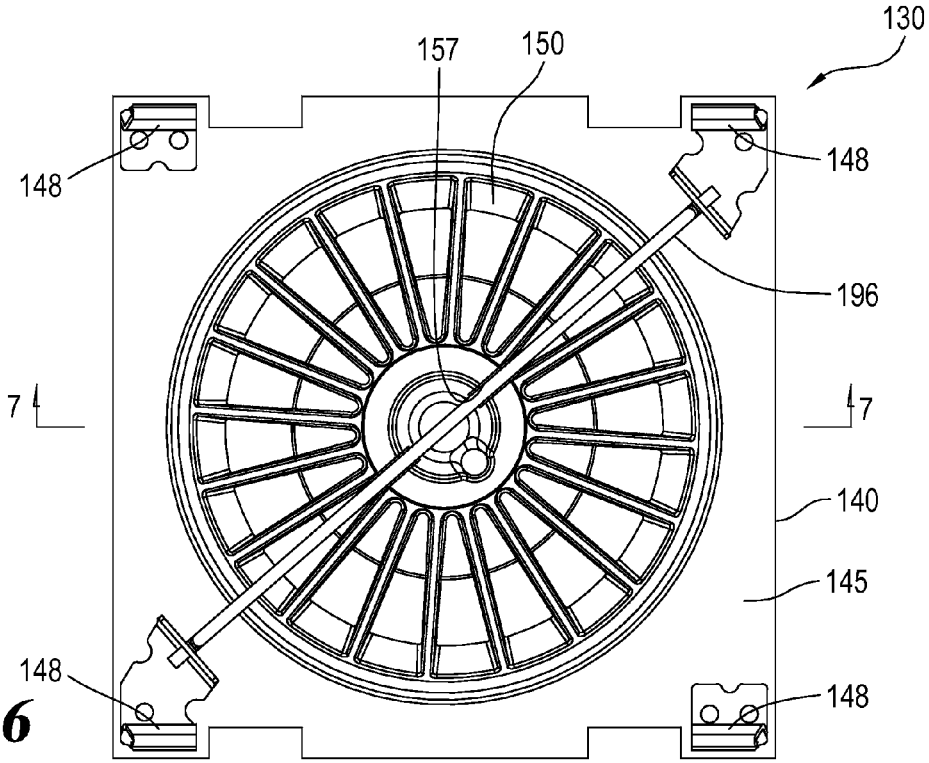
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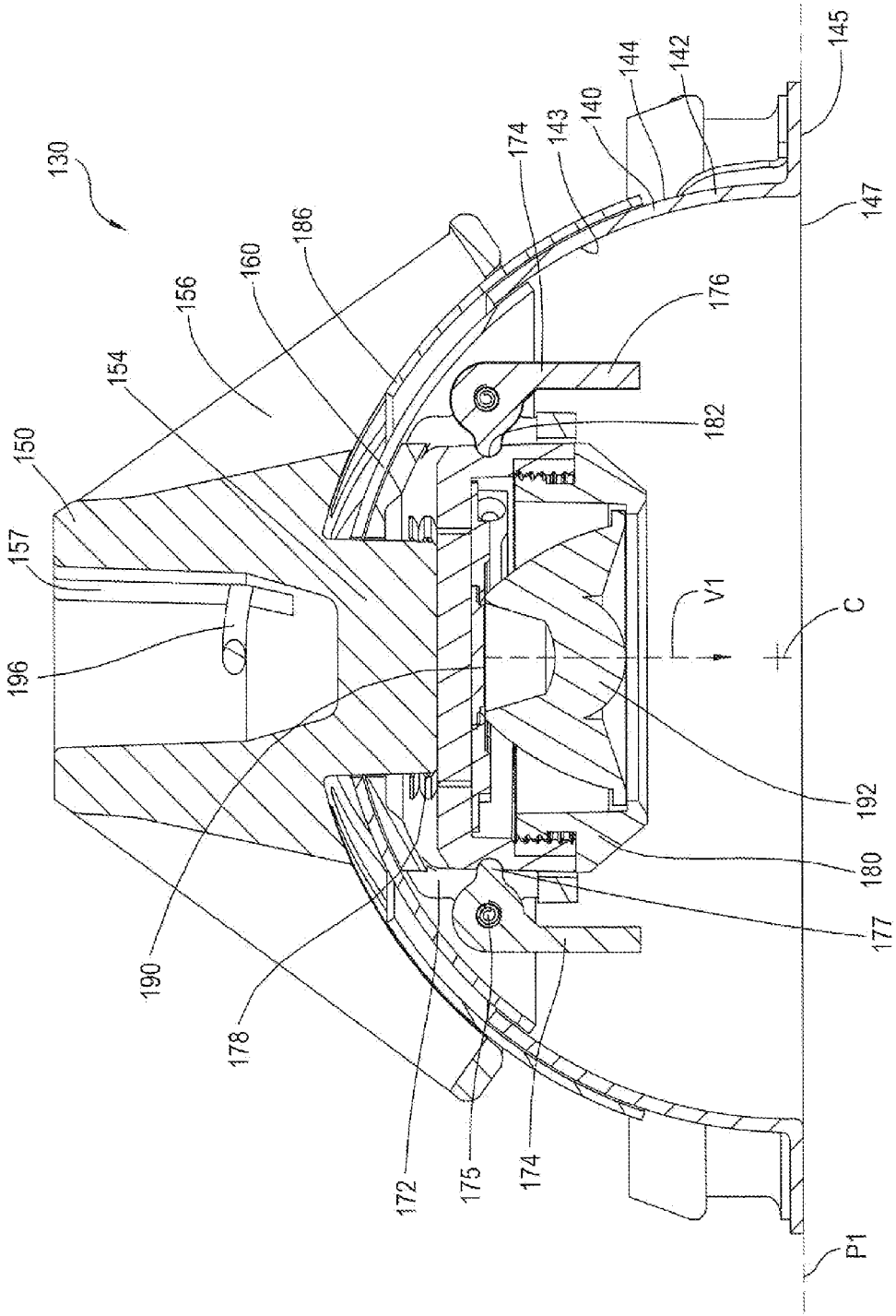
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*Fig. 7*

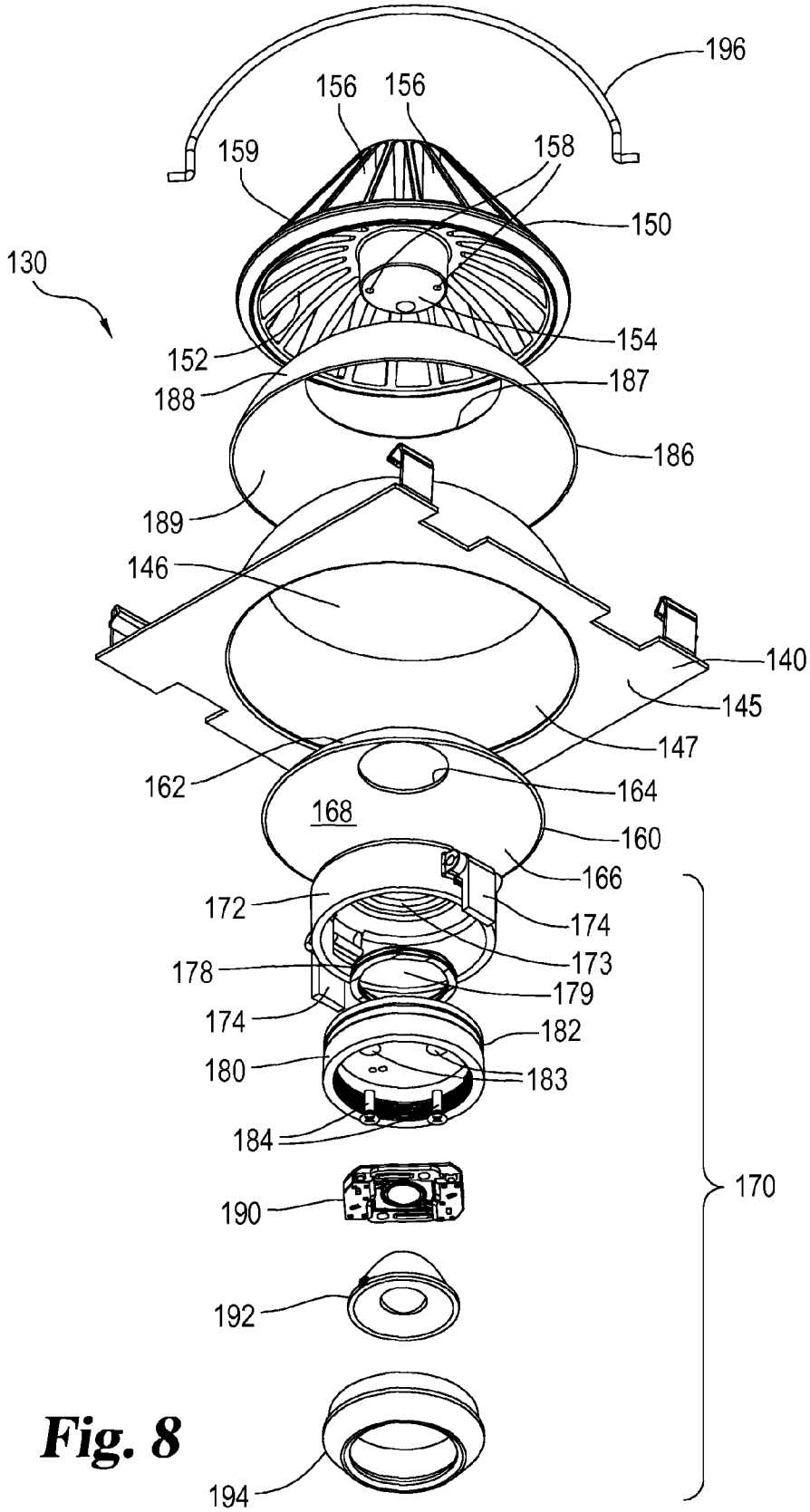
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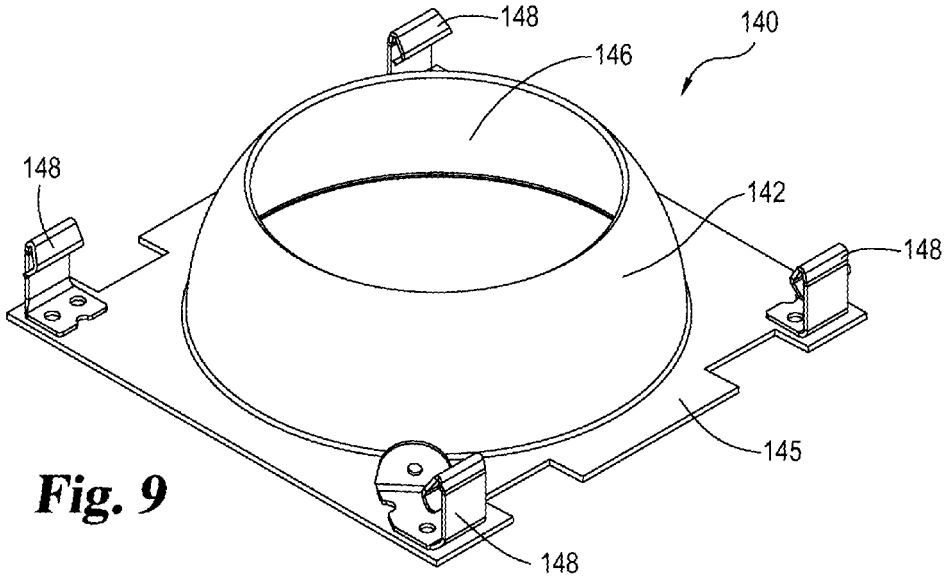
*Fig. 8*

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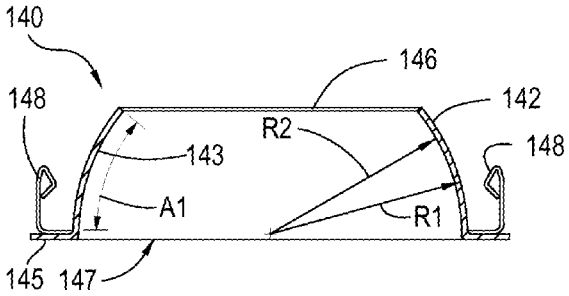


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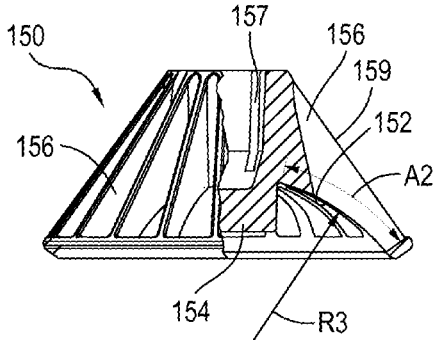


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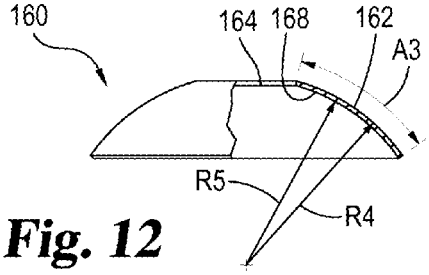


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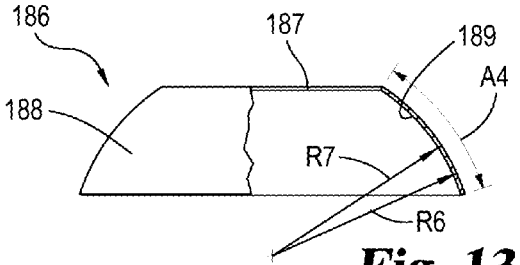


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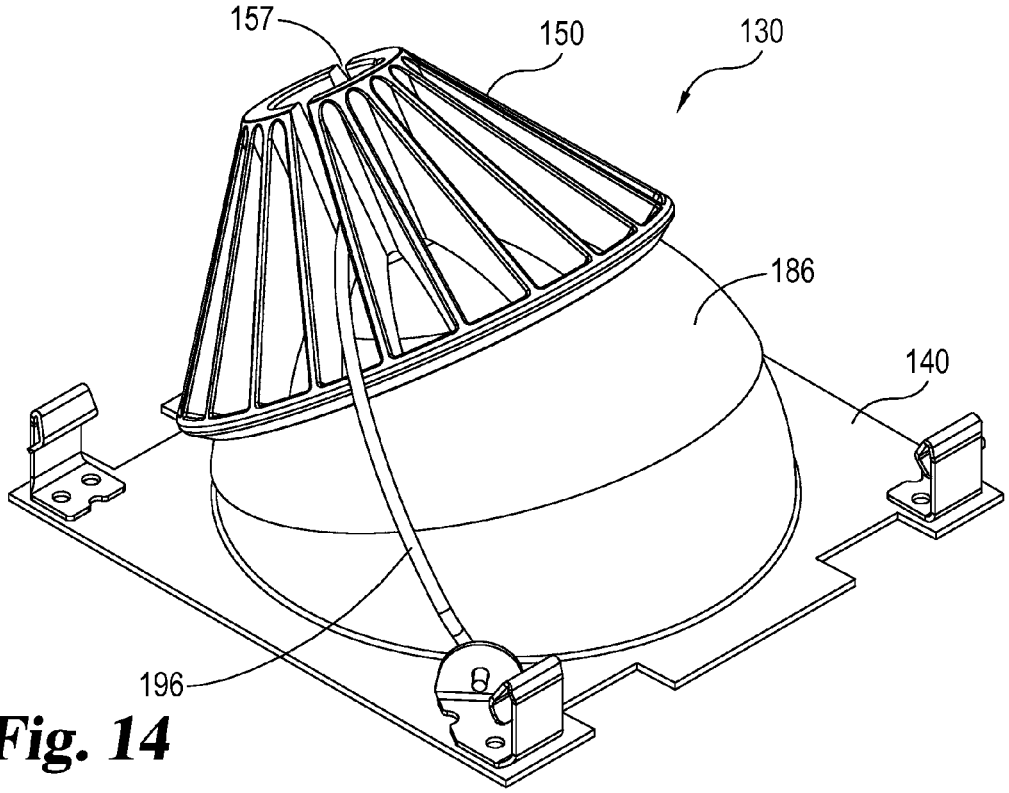


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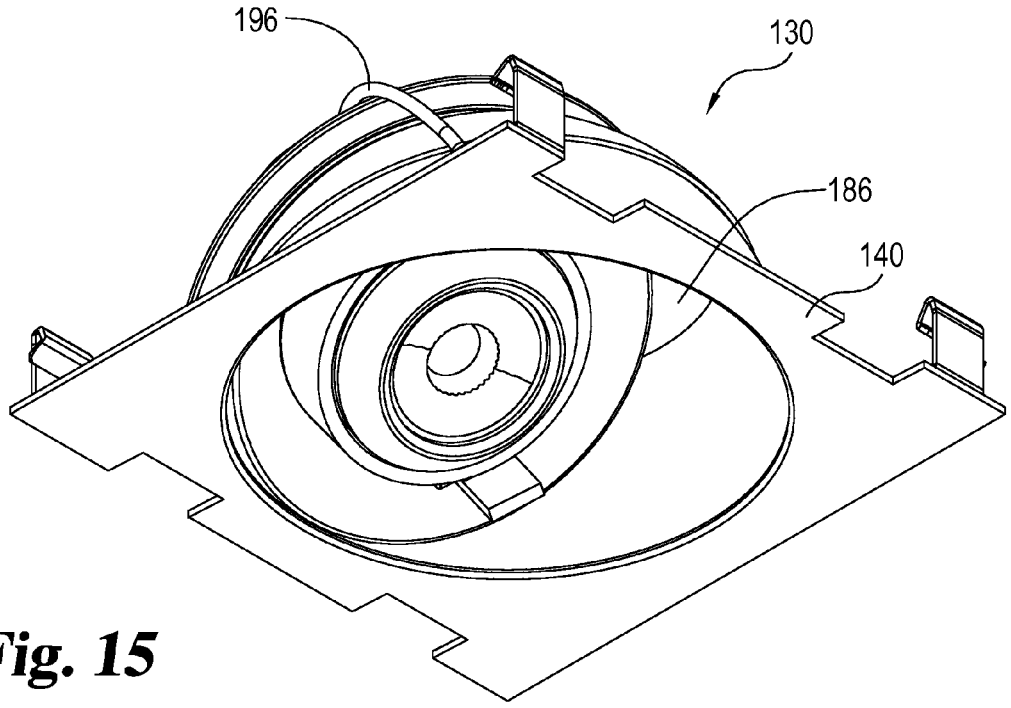


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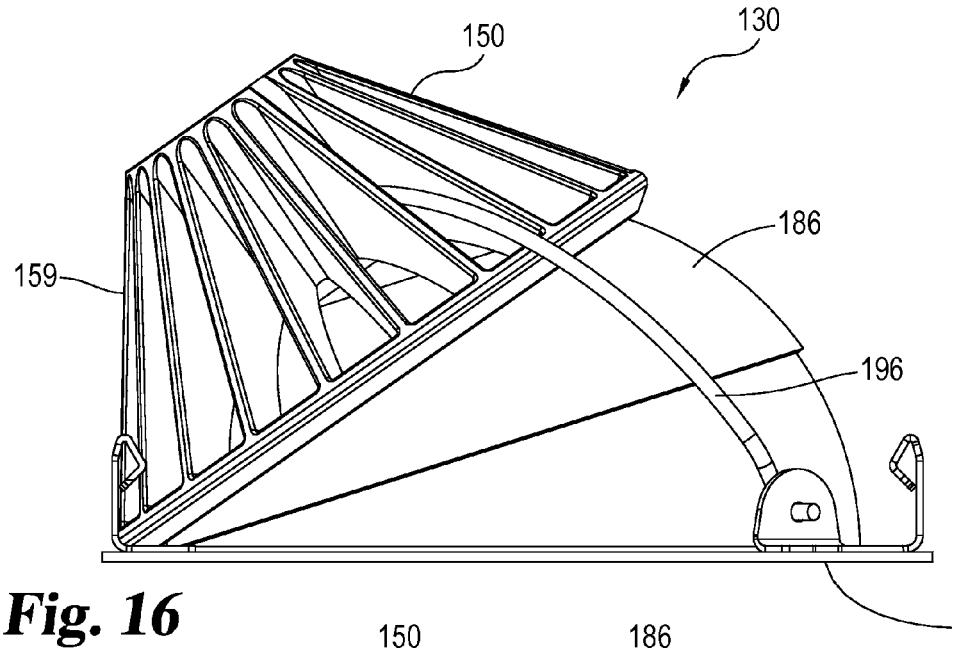


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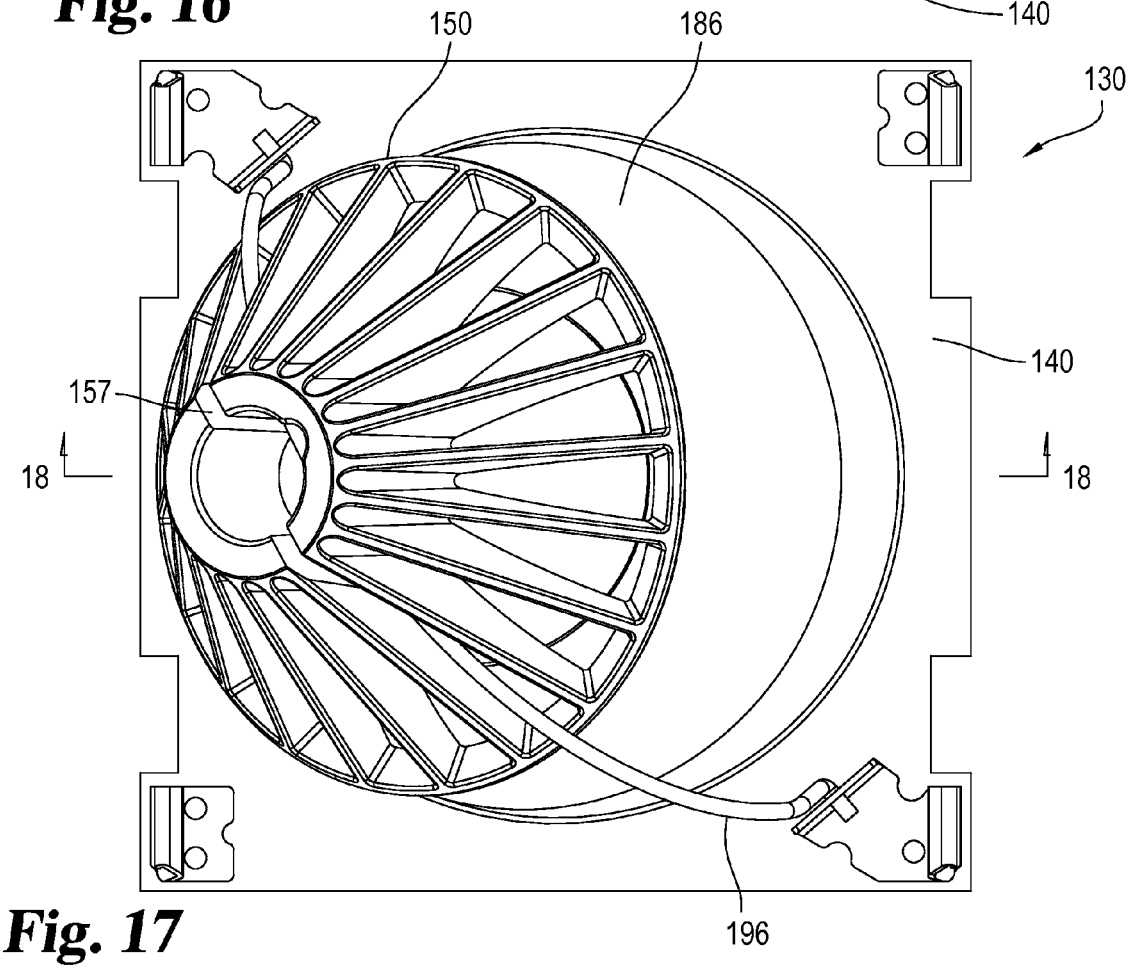


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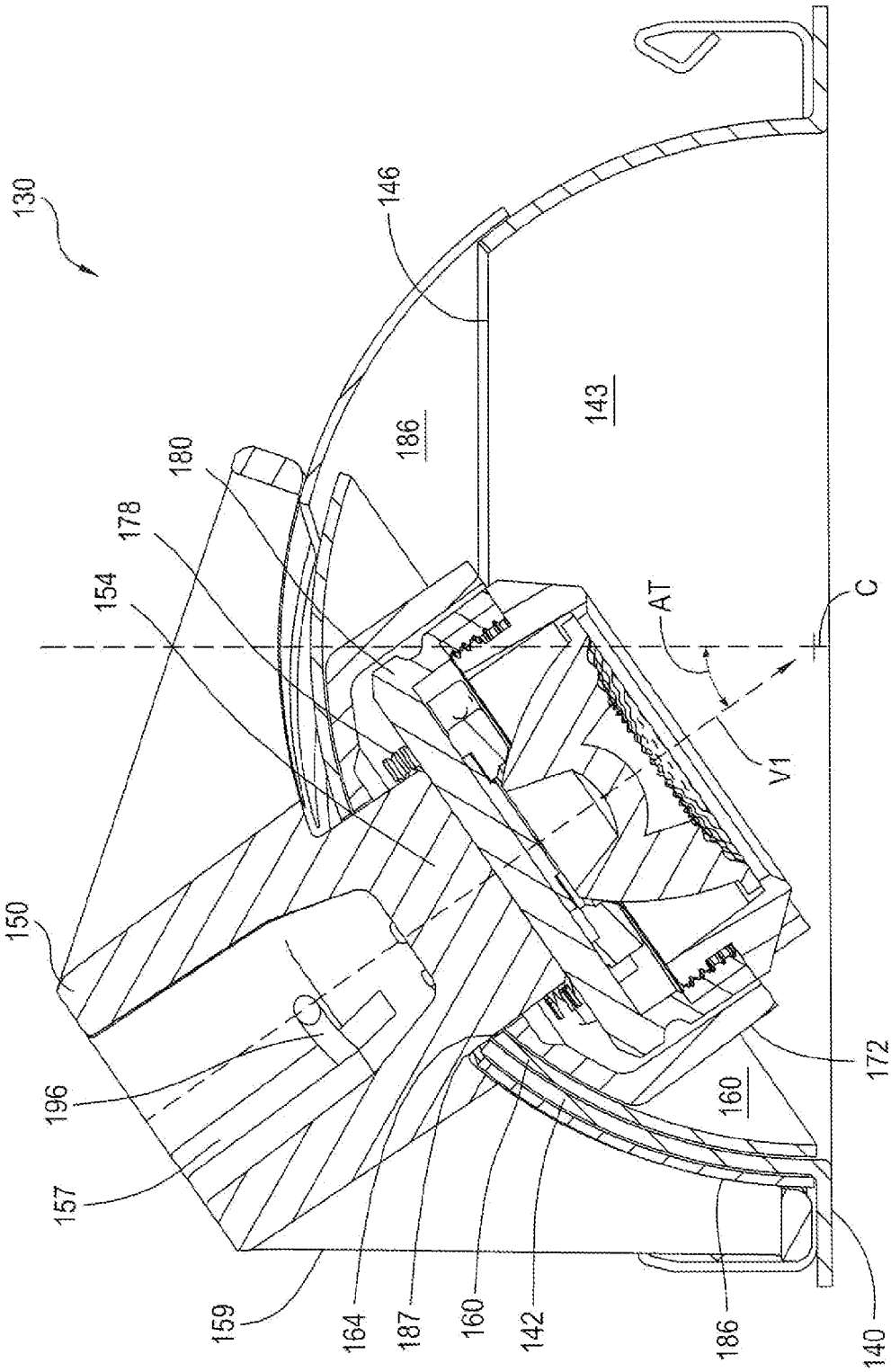
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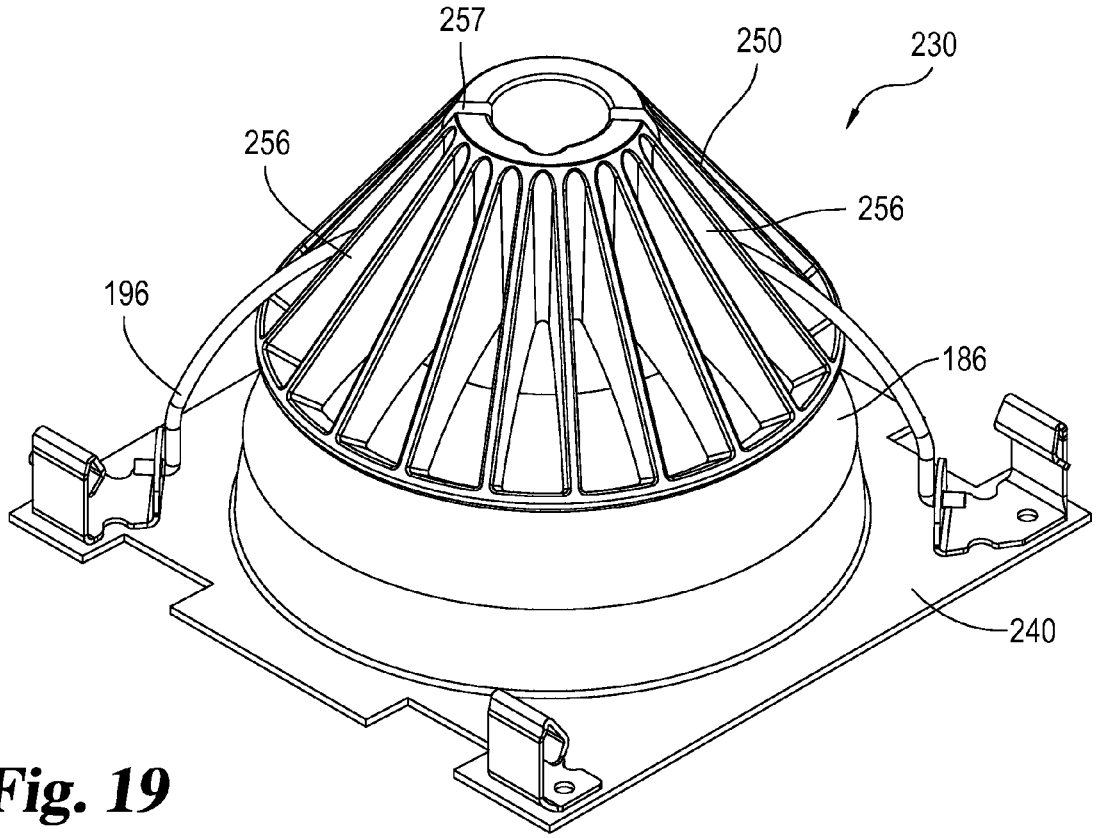
Fig. 18

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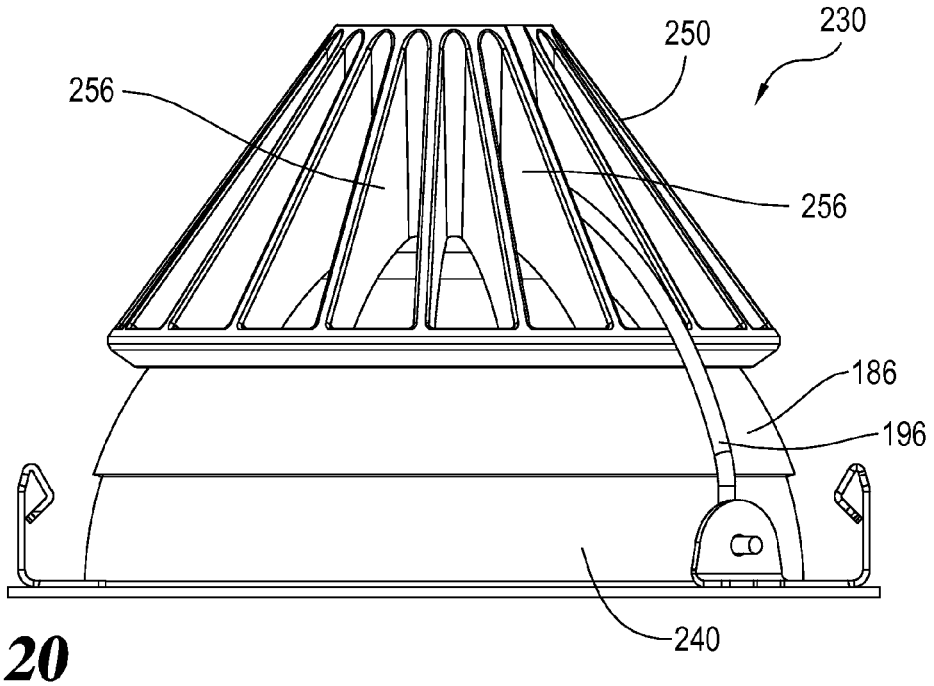


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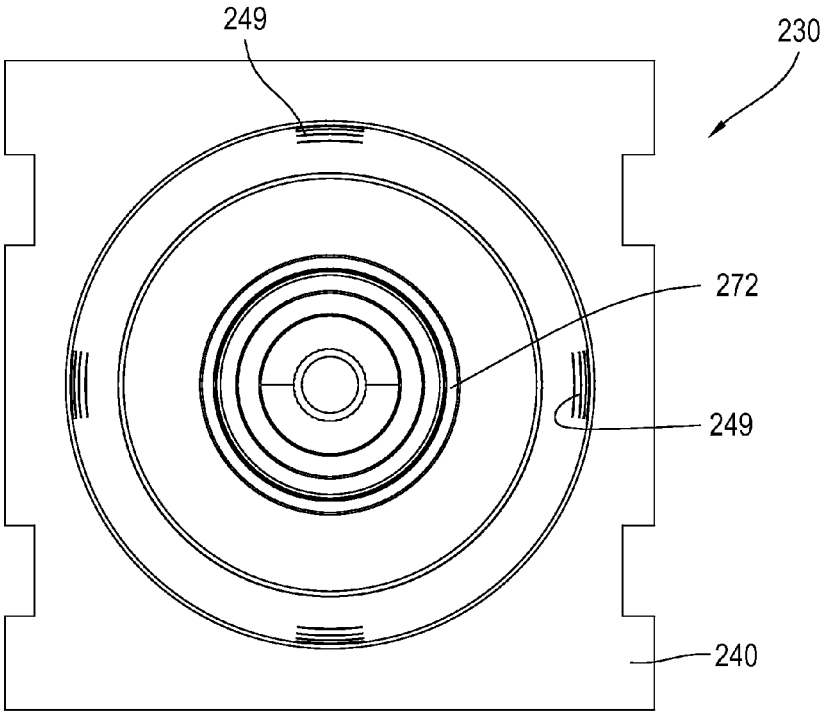


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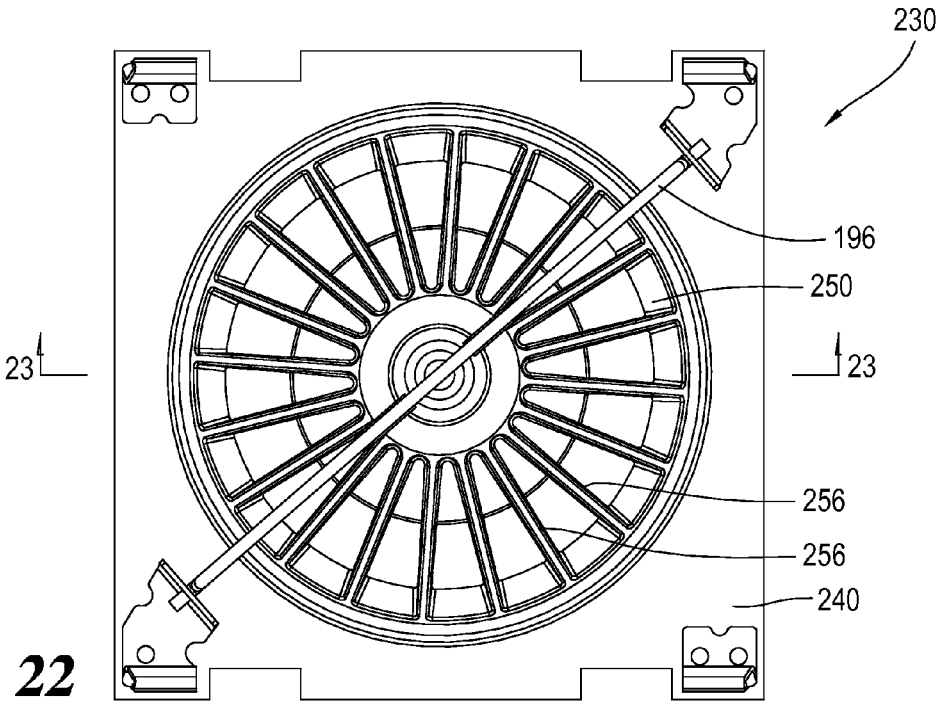


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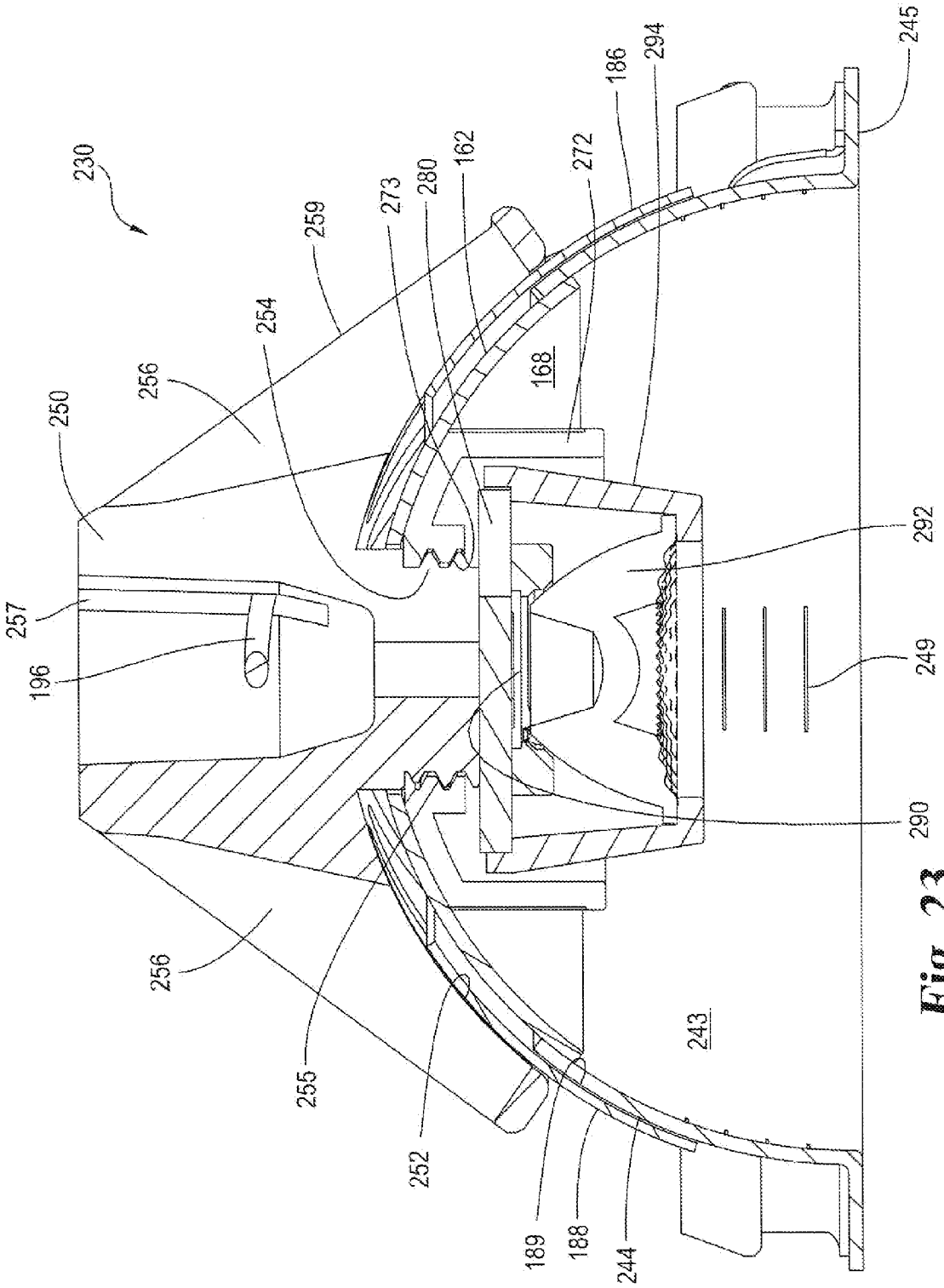
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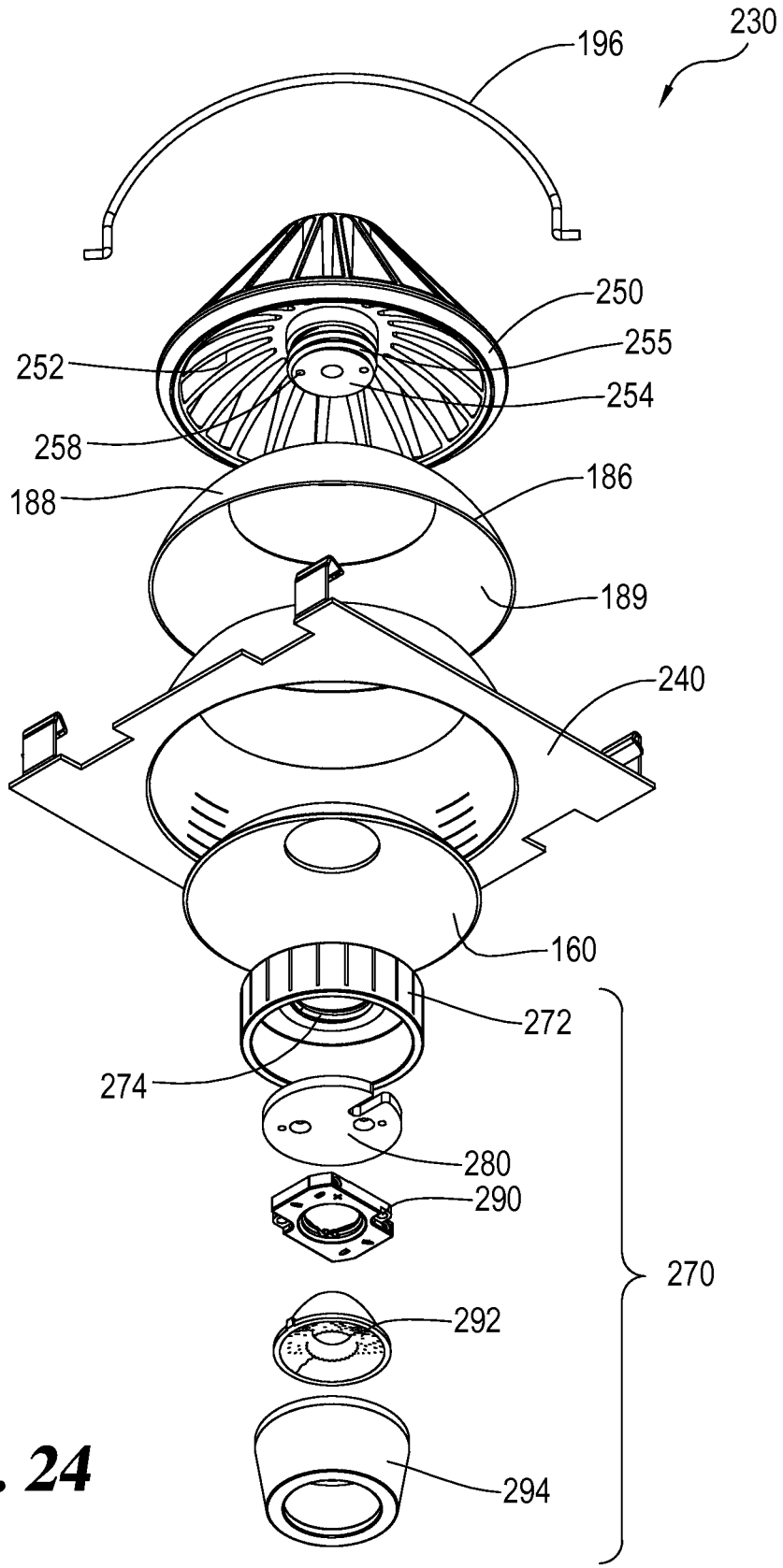
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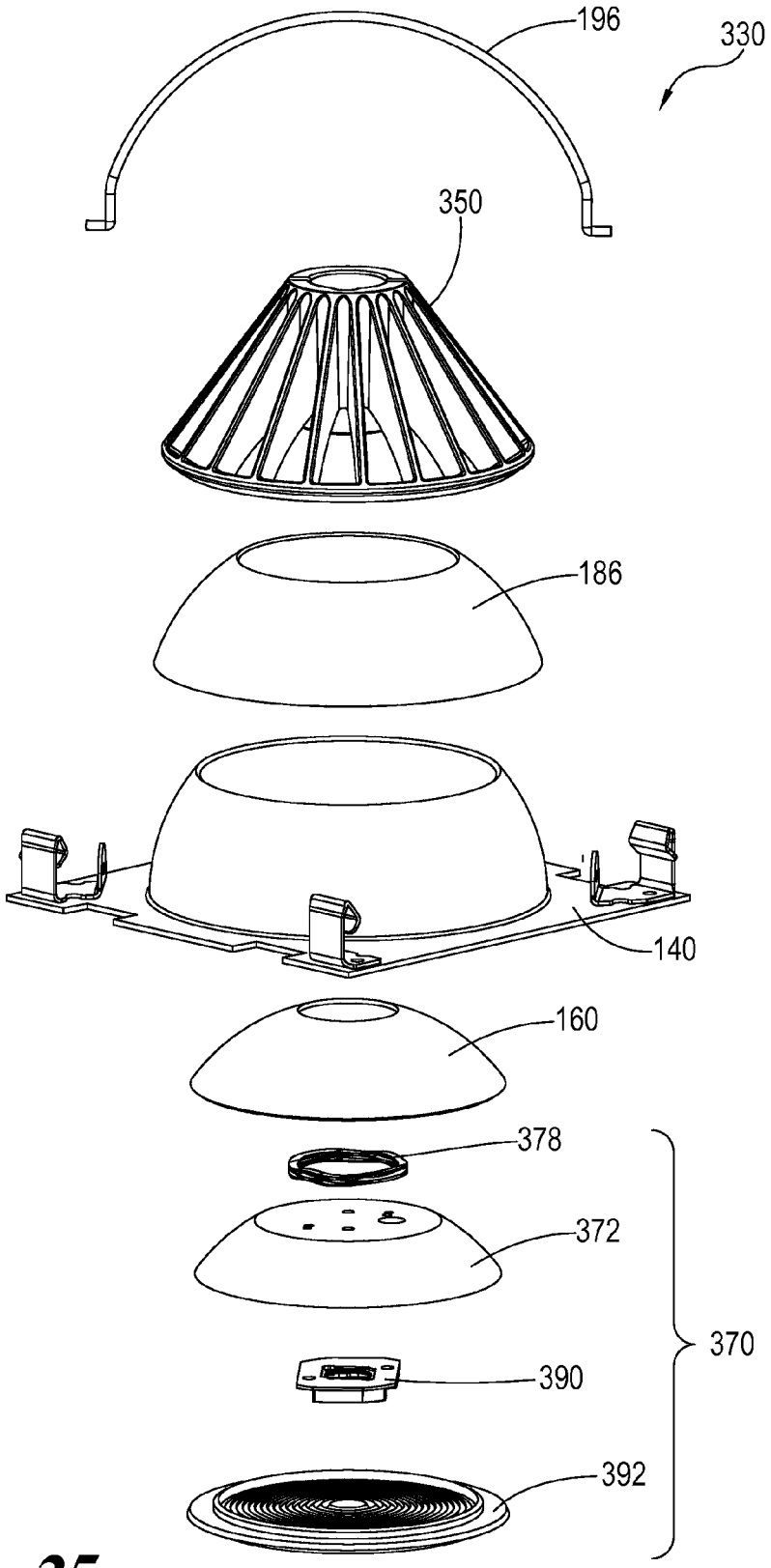
*Fig. 24*

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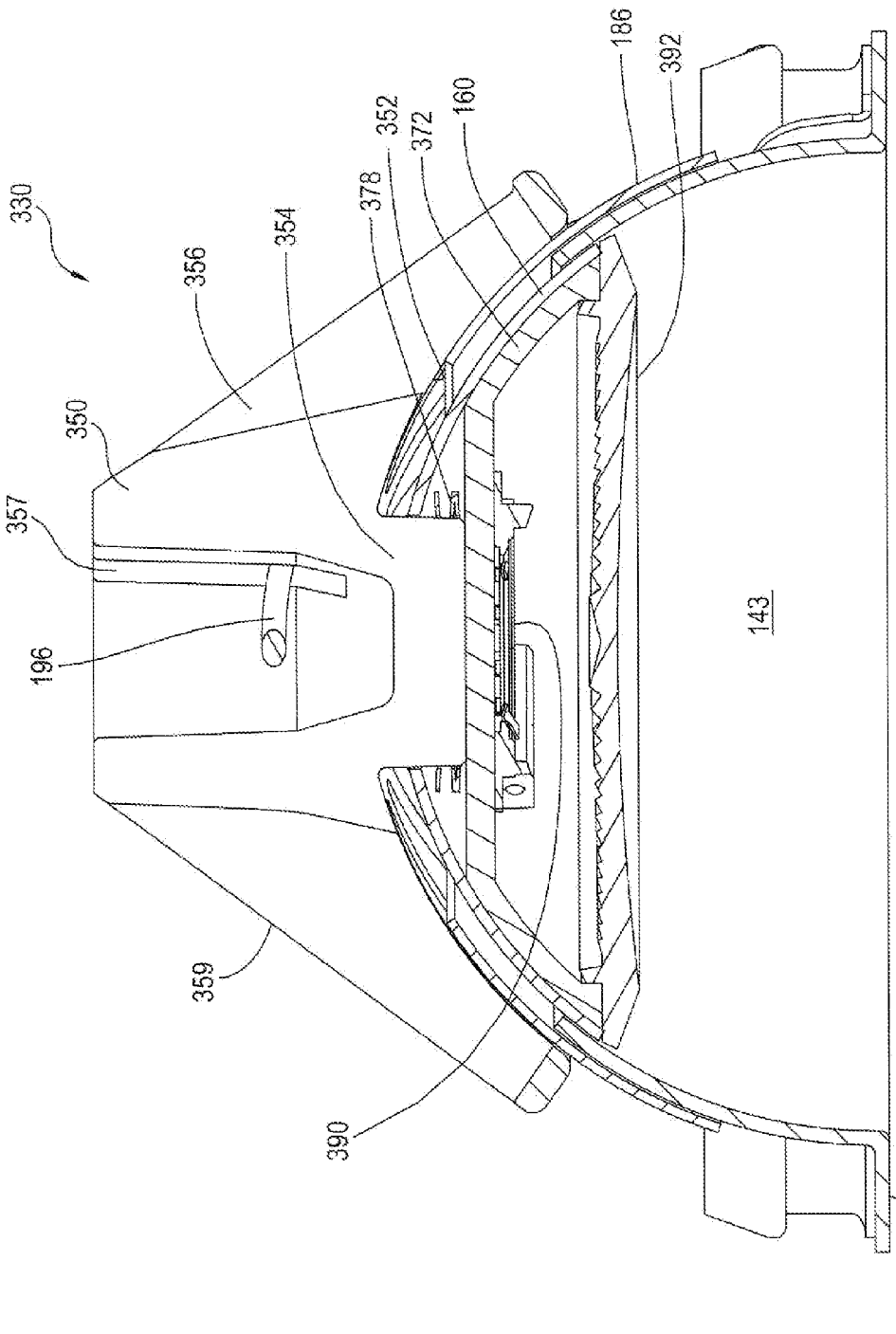


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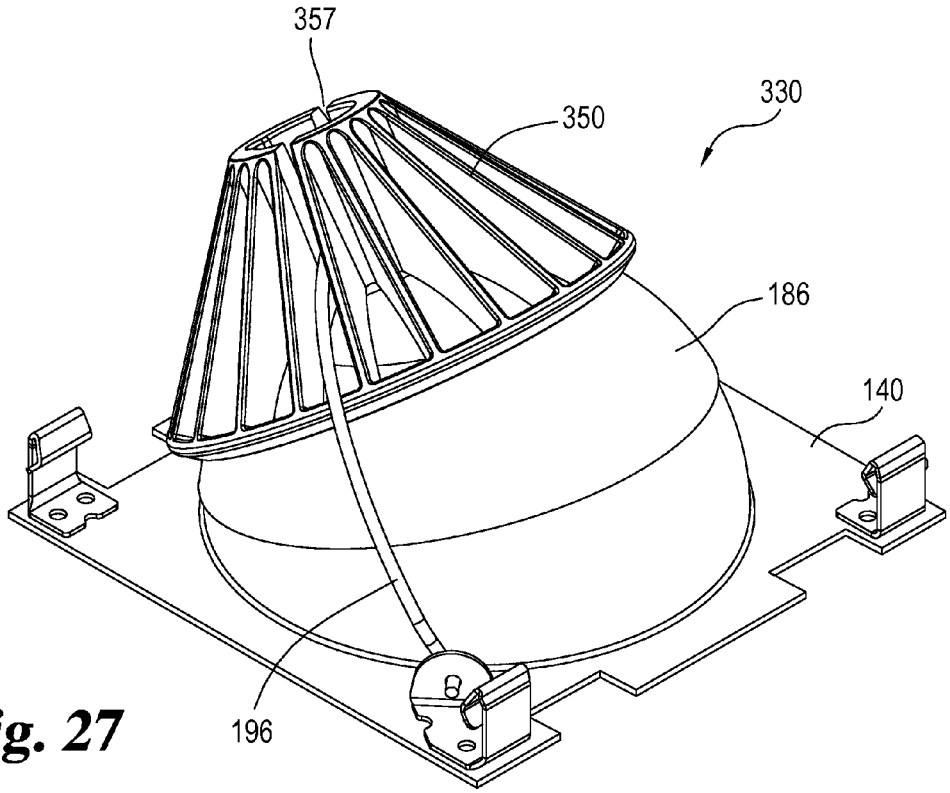


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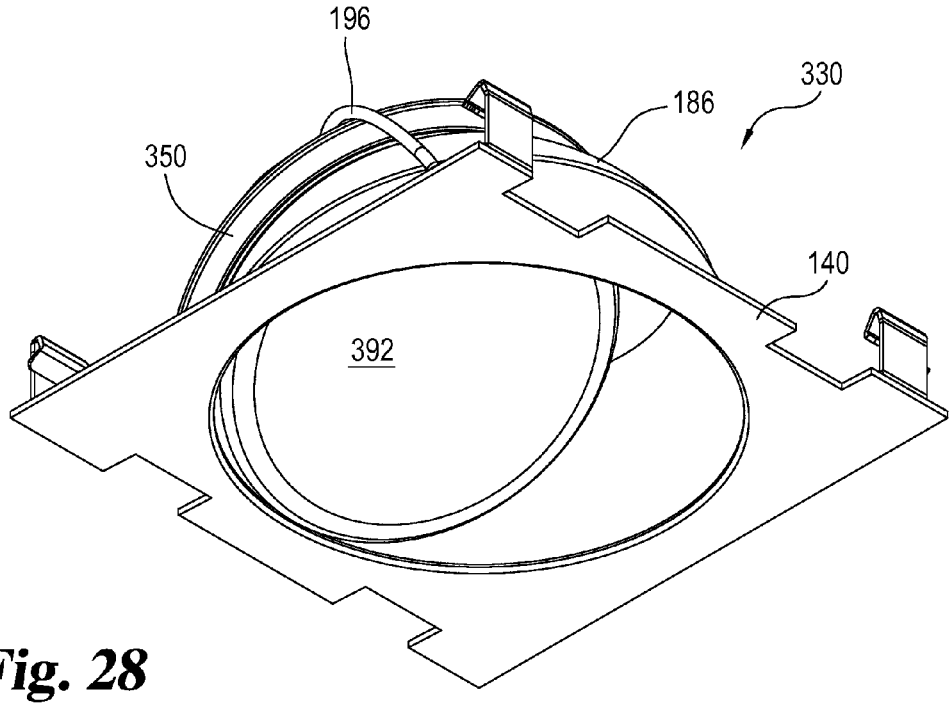


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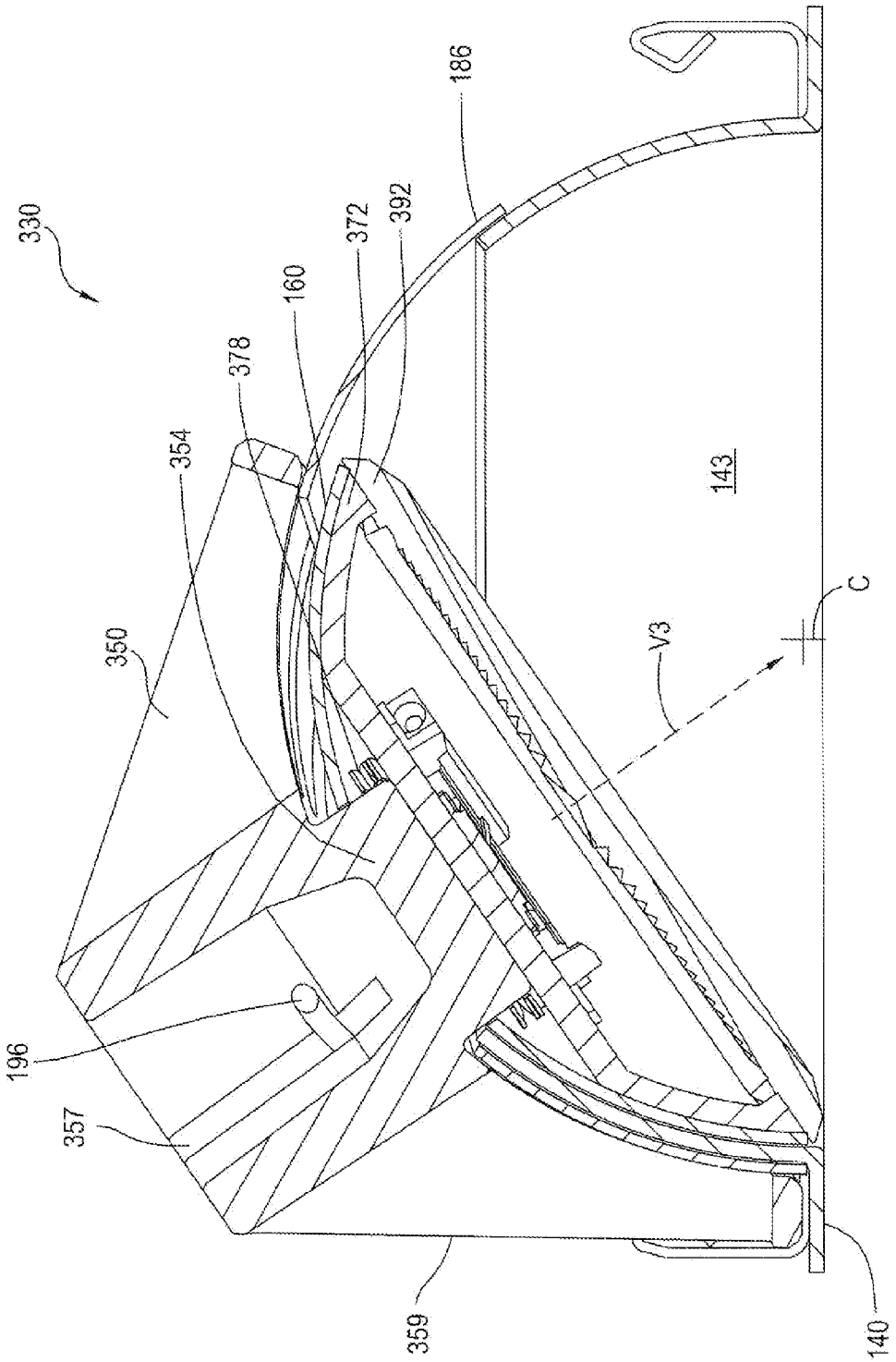


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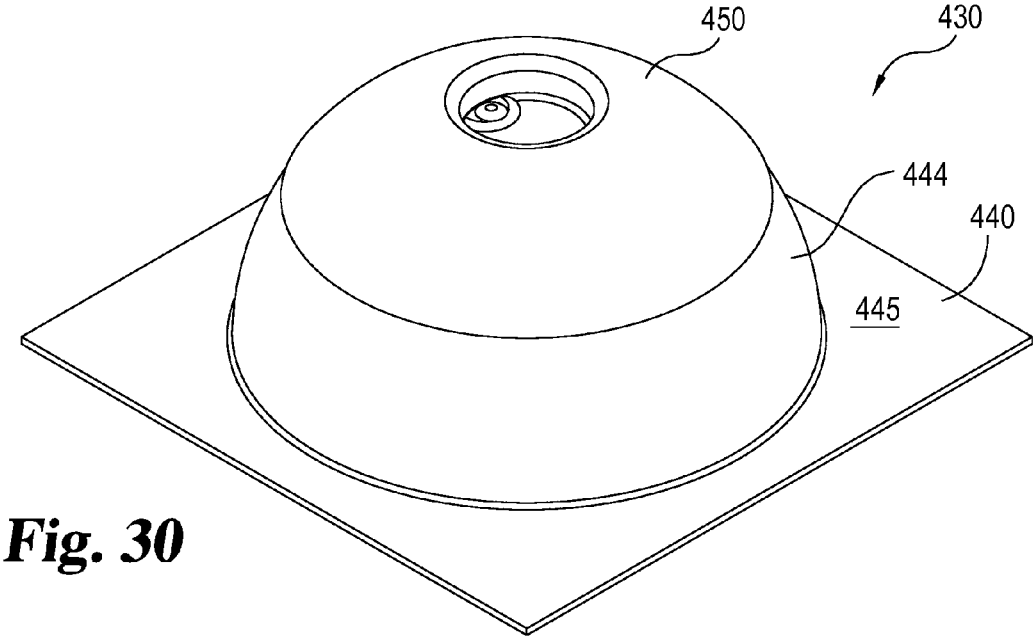


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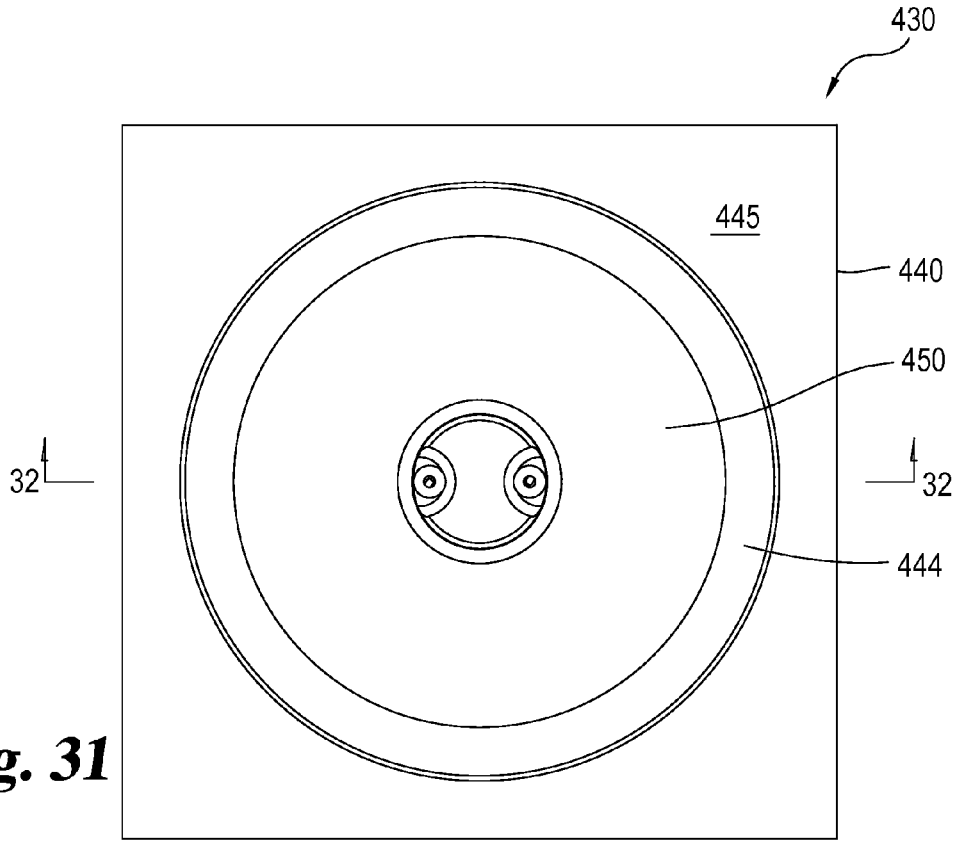


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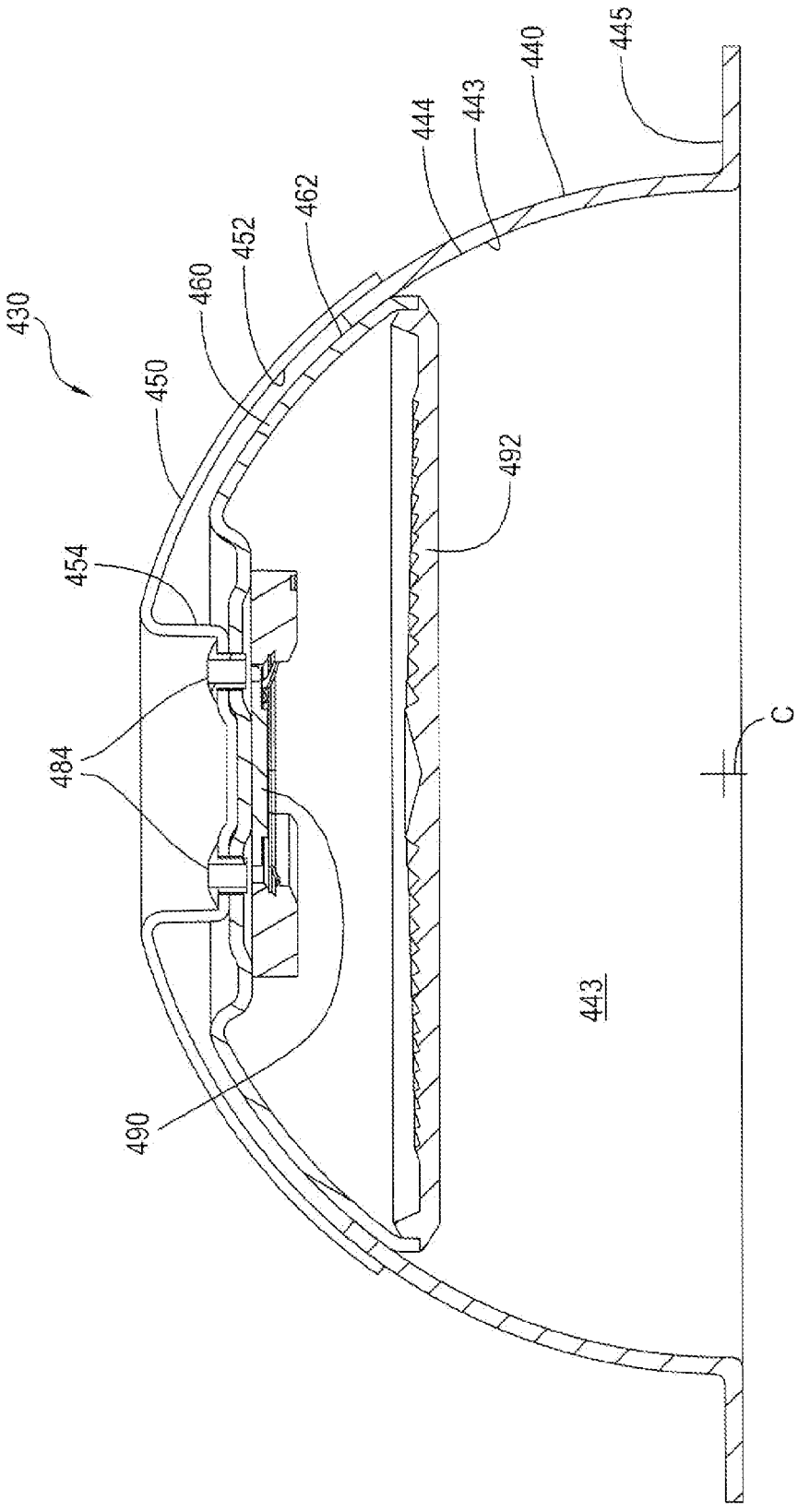


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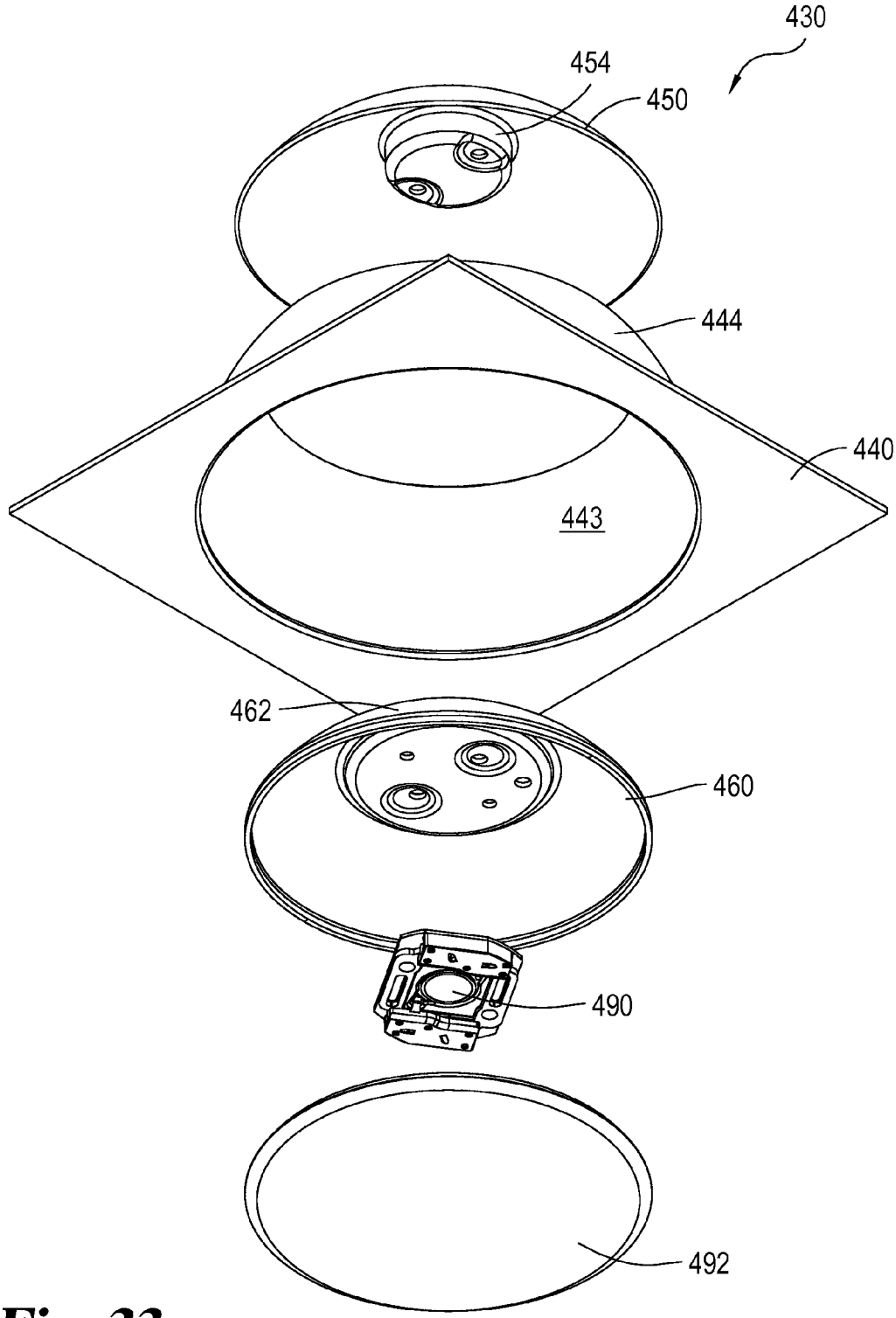


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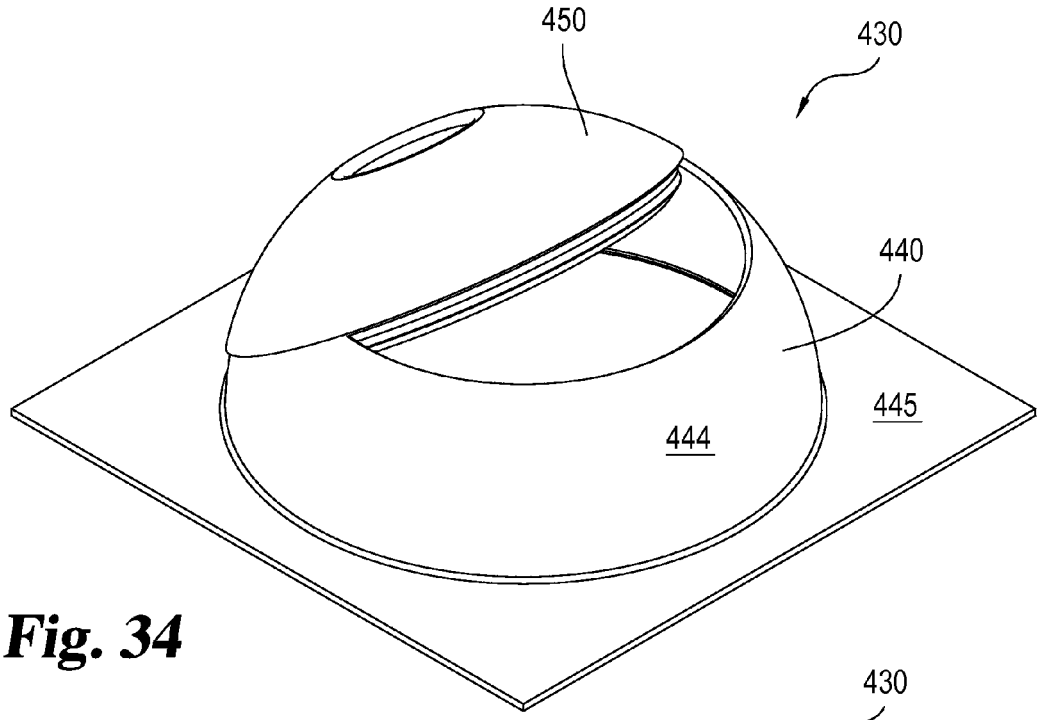


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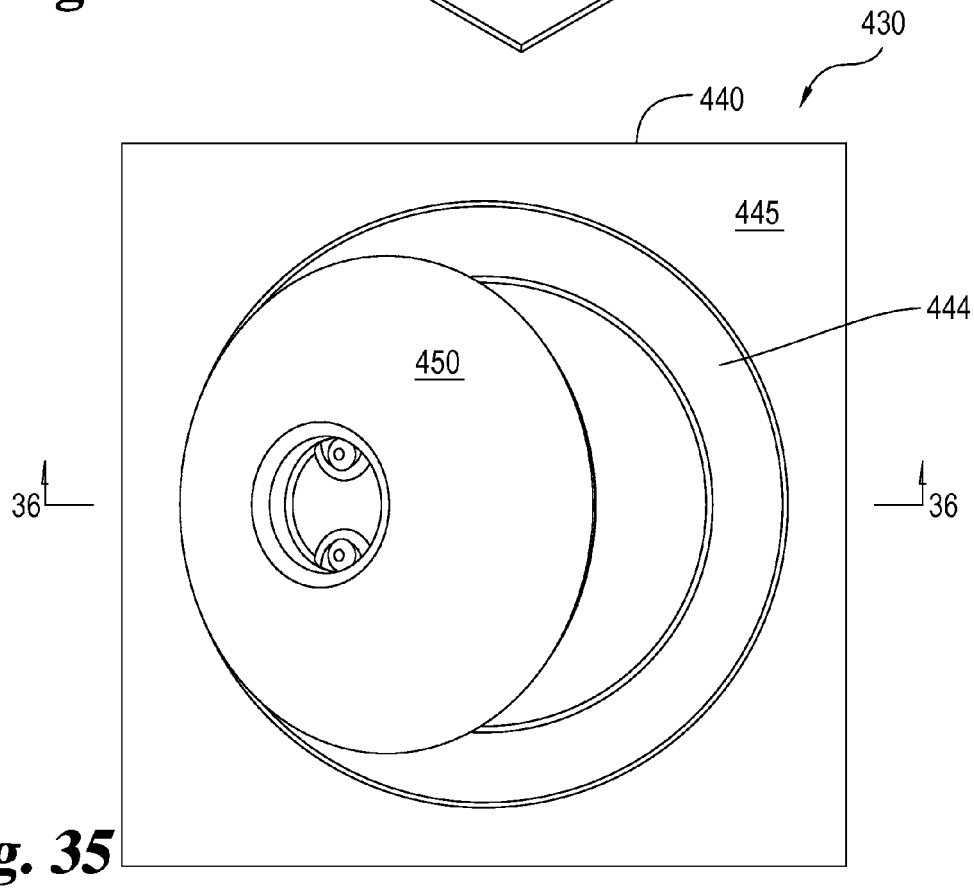


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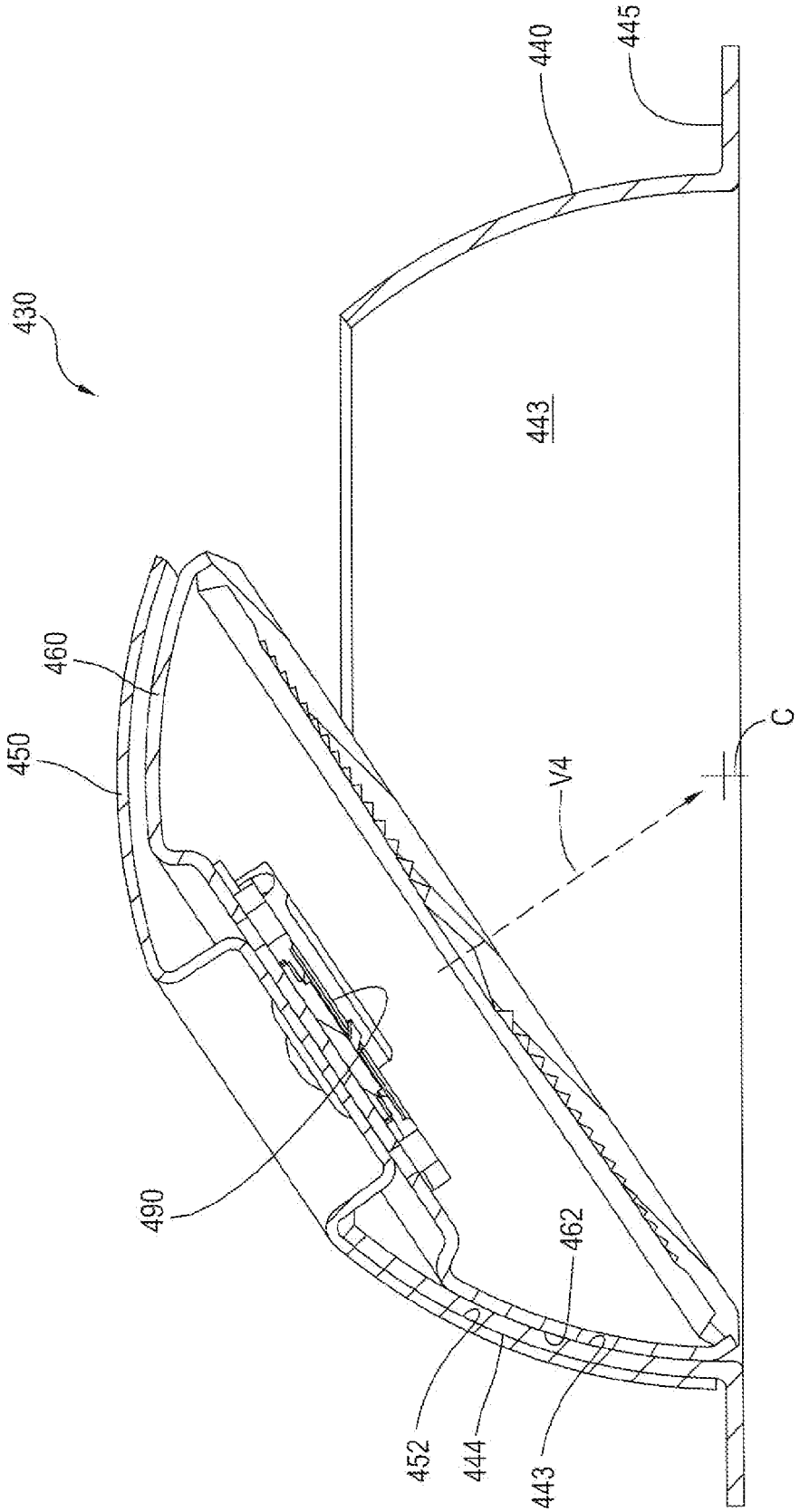


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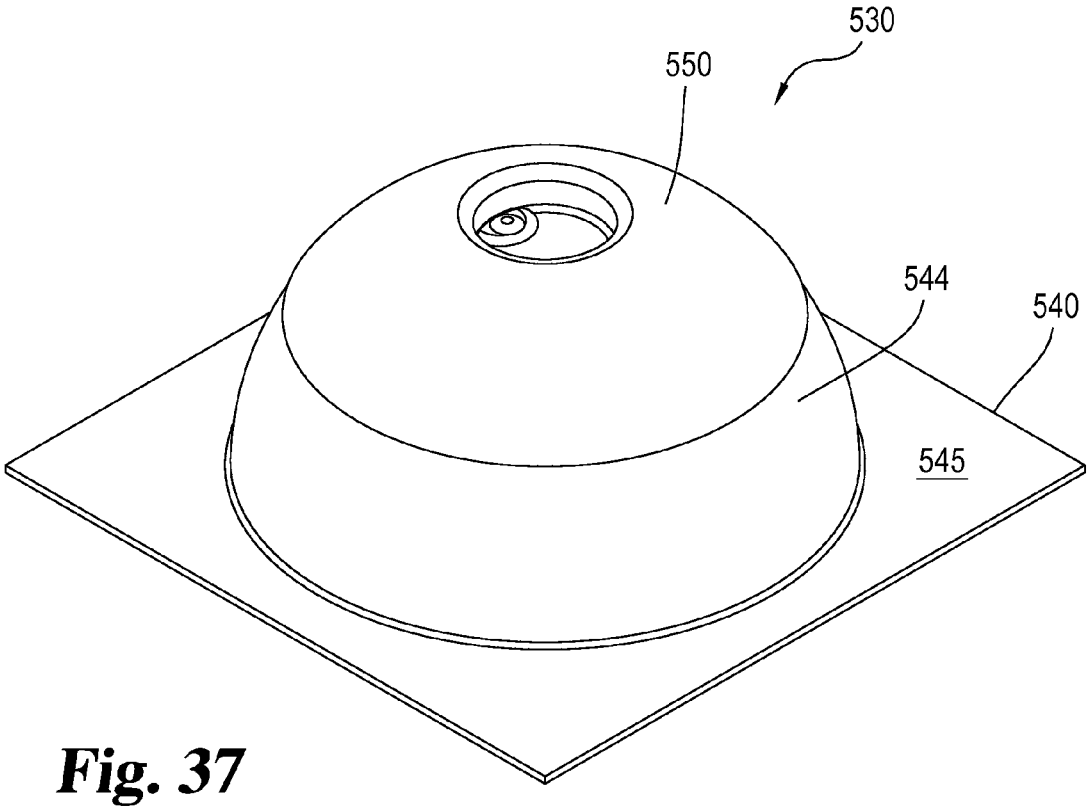


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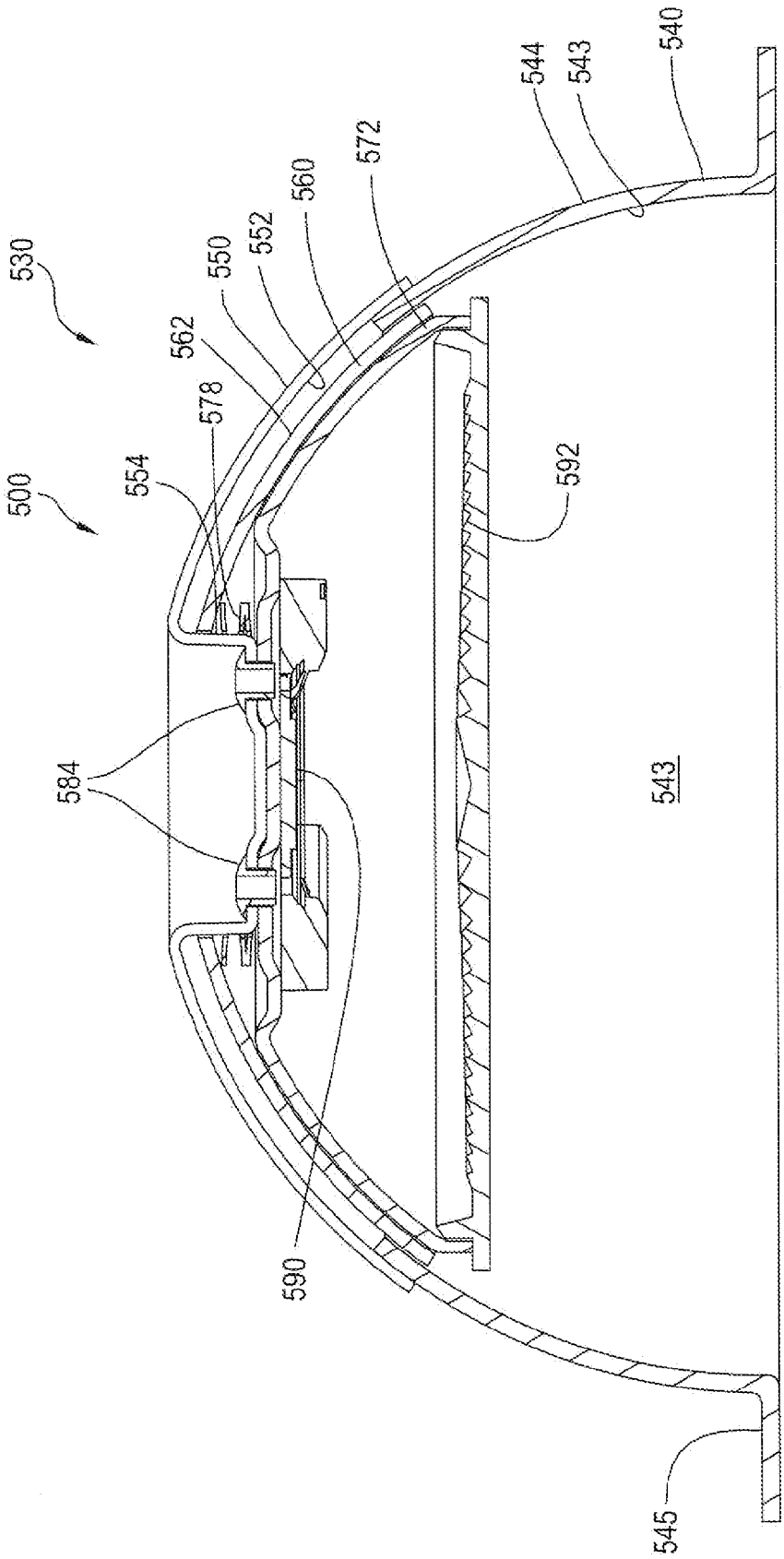
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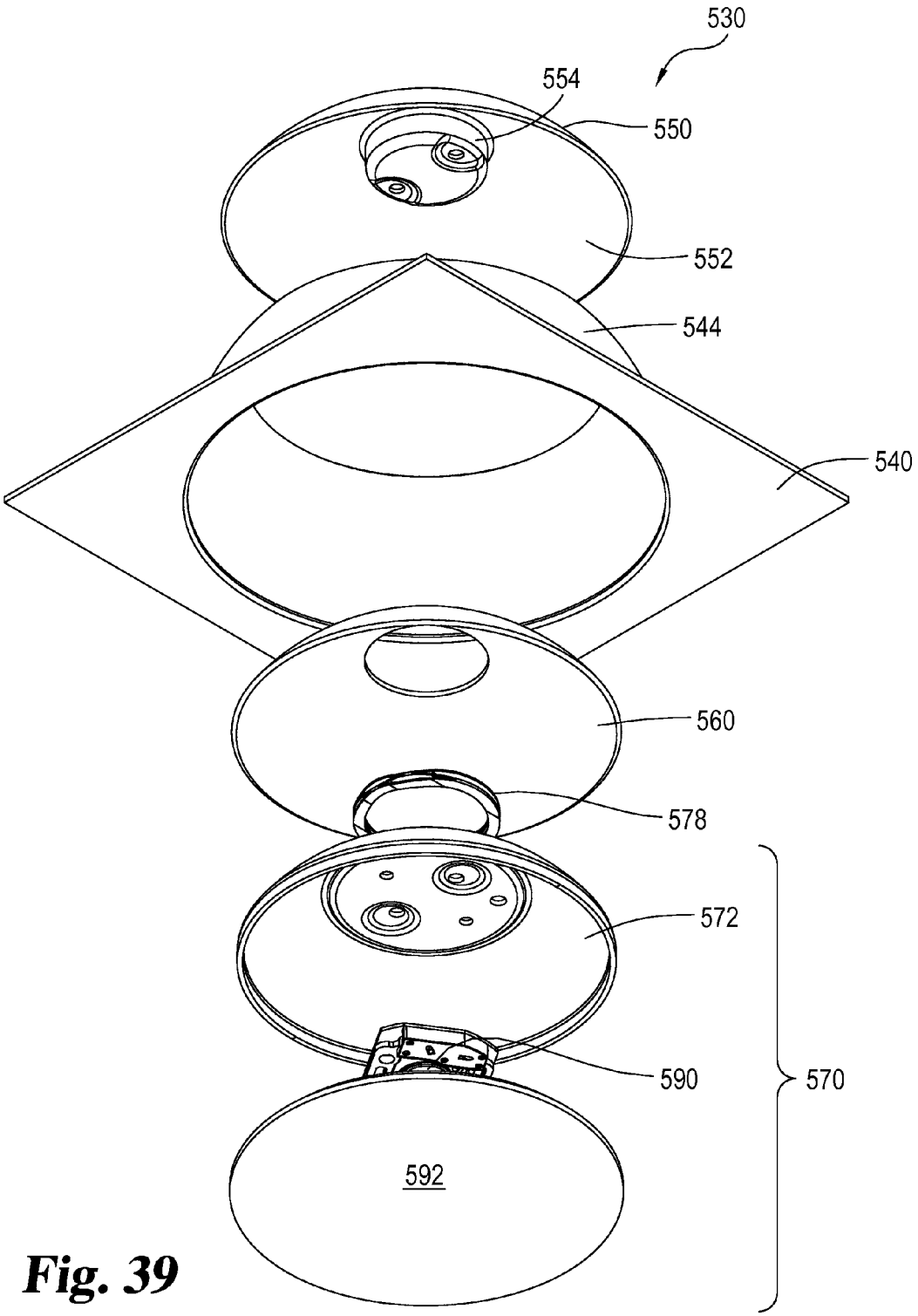


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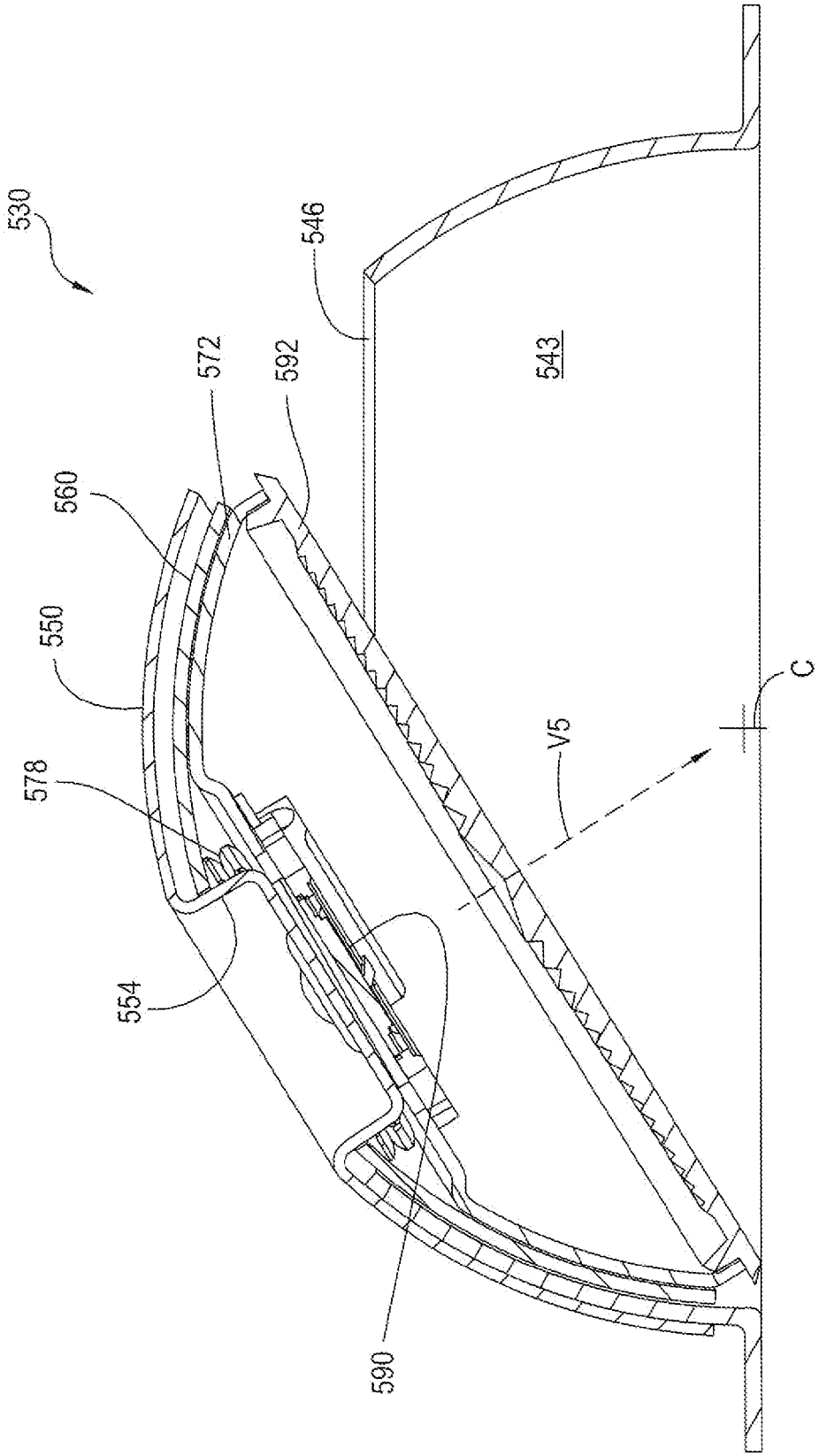


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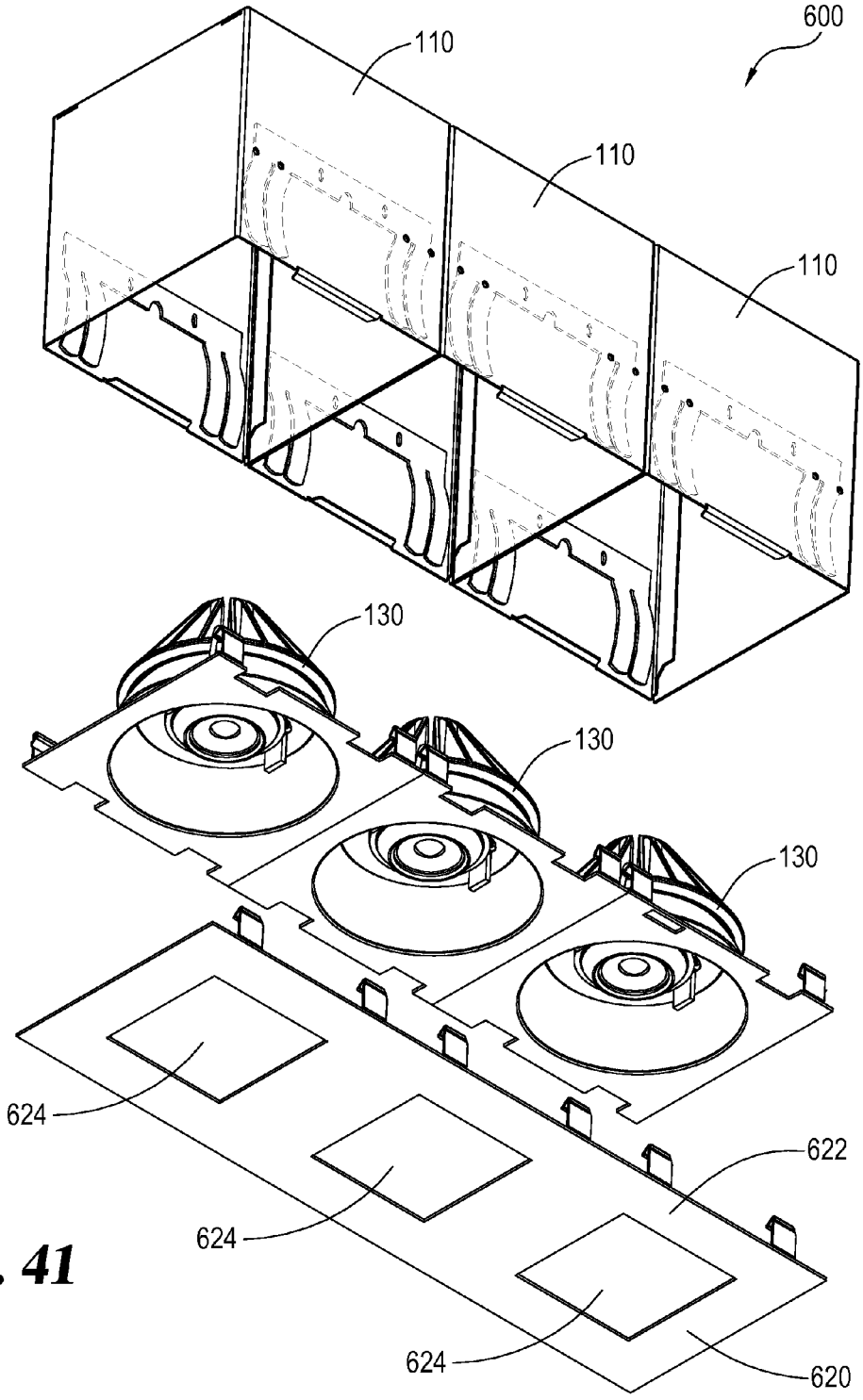


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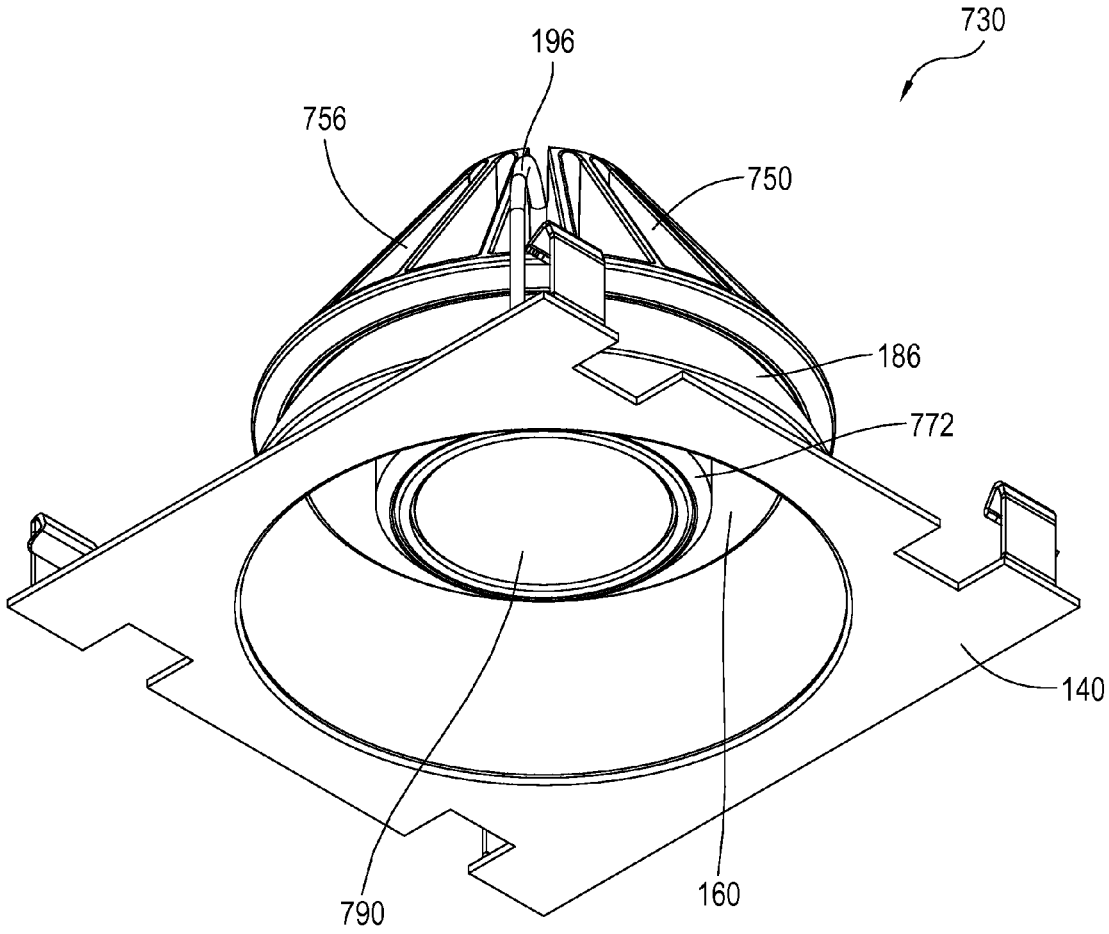


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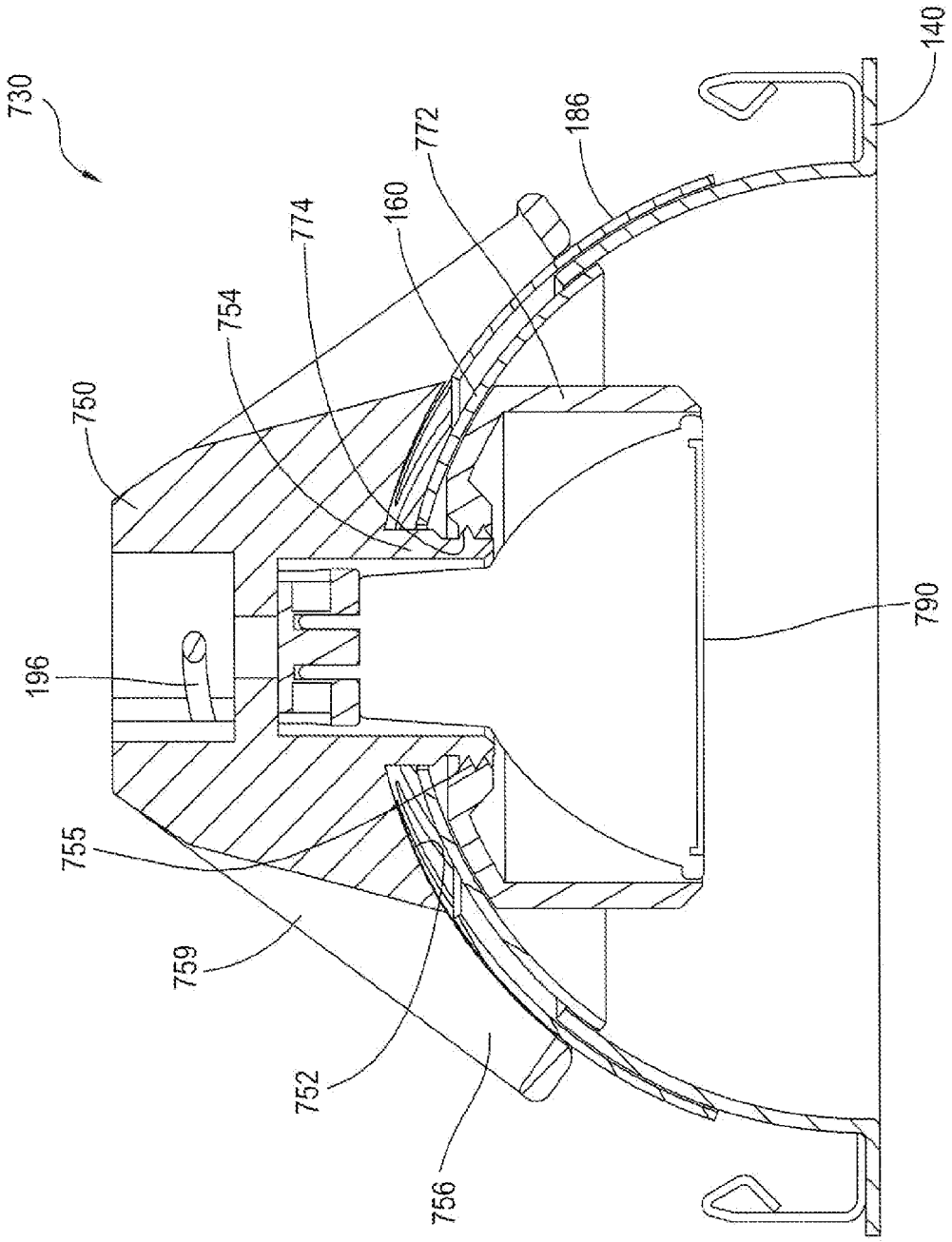


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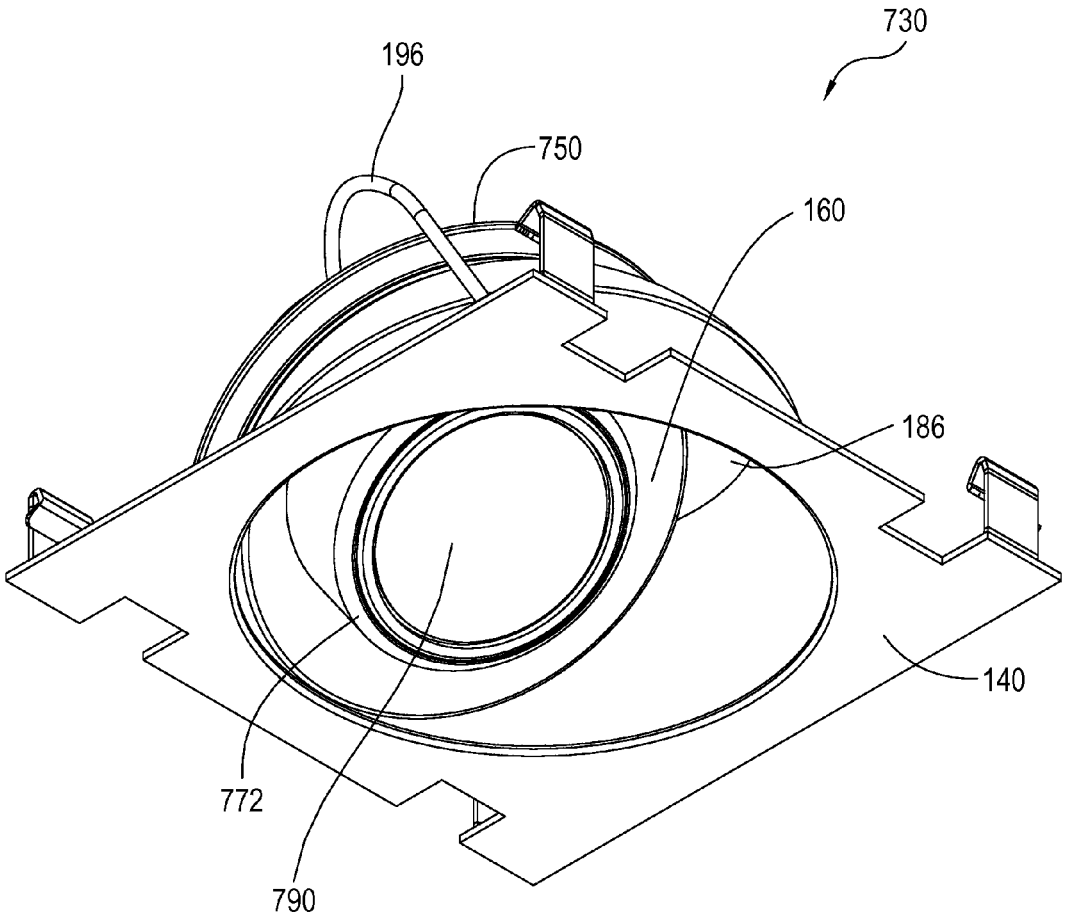


*Fig. 44*

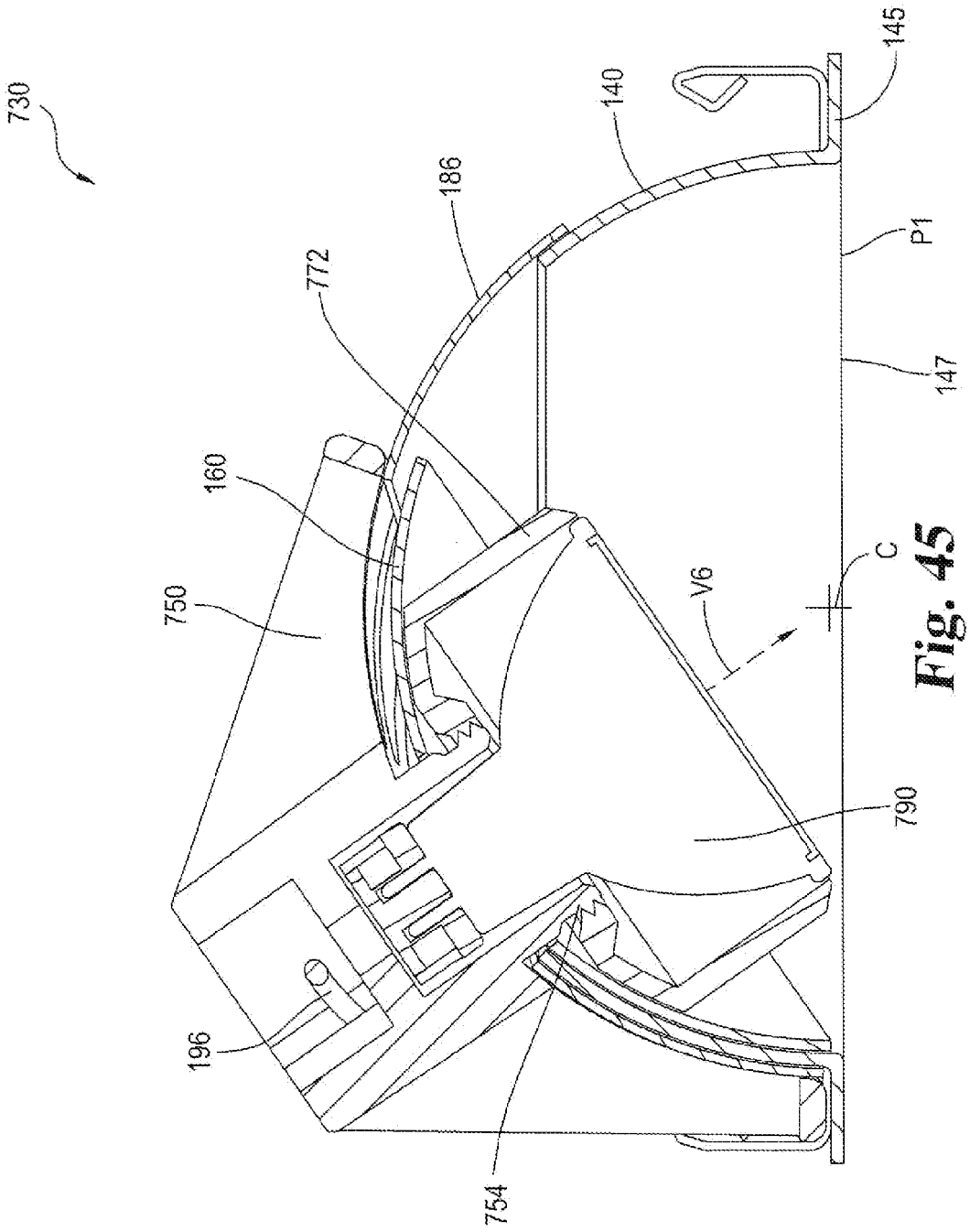


Fig. 45

# ADJUSTABLE LUMINAIRE

## BACKGROUND

There is a need for attractive adjustable recessed lighting in residential and commercial environments. Other common needs for residential and commercial lighting includes energy efficiency, size and cost.

Light Emitting Diodes (LEDs) are one current type of an energy efficient light source. LEDs are thermally sensitive by nature, and some high-output LEDs require a heat sink for extended operation. Many heat sink designs are large and can limit how closely the LEDs can be placed next to each other. If the fixture is adjustable (amiable), the individual lights may require extra spacing so that the heat sinks do not interfere or collide with each other.

In many applications it is desirable for recessed lighting to have a pleasing appearance which can be defined by minimal visibility and a clean, "quiet" look from below the ceiling or wall in which it is installed. For this reason, a trim can be used to cover part of the luminaire, creating clean "frame" around an aperture where the light shines through. In some cases, adjusting the direction a light in a luminaire points may result in a significant portion of the emitted light shining on the trim, rather than passing through the aperture, resulting in reduced luminous flux from the luminaire.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a light fixture.

FIG. **2** is a top perspective exploded view of the FIG. **1** light fixture including an enclosure, an adjustable assembly and a trim piece.

FIG. **3** is the bottom perspective exploded view of the FIG. **1** light fixture.

FIG. **4** is a top perspective view of the adjustable assembly portion of the FIG. **1** light fixture.

FIG. **5** is a bottom plan view of the FIG. **4** adjustable assembly.

FIG. **6** is a top plan view of the FIG. **4** adjustable assembly.

FIG. **7** is a side elevational cross-sectional view of the FIG. **4** adjustable assembly taken along line **7-7** in FIG. **6**.

FIG. **8** is a bottom perspective exploded assembly view of the FIG. **4** adjustable assembly.

FIG. **9** is a top perspective view of a main body, an element of the FIG. **4** adjustable assembly.

FIG. **10** is a side elevational cross-sectional view of the FIG. **9** main body.

FIG. **11** is a side elevational view of an outer member, an element of the FIG. **4** adjustable assembly, including a partial cross-sectional view.

FIG. **12** is a side elevational view of an inner member, an element of the FIG. **4** adjustable assembly, including a partial cross-sectional view.

FIG. **13** is a side elevational view of an intermediate member, an element of the FIG. **4** adjustable assembly, including a partial cross-sectional view.

FIG. **14** is a top perspective view of the FIG. **4** adjustable assembly with the outer member skewed at an angle relative to the main body.

FIG. **15** is a bottom perspective view of the FIG. **14** configuration.

FIG. **16** is a side elevational view of the FIG. **14** configuration.

FIG. **17** is a top plan view of the FIG. **14** configuration.



FIG. **18** is a side elevational cross-sectional view of the FIG. **14** configuration taken along line **18-18** on FIG. **17**.

FIG. **19** is a top perspective view of a second embodiment of an adjustable assembly.

FIG. **20** is a side elevational view of the FIG. **19** adjustable assembly.

FIG. **21** is a bottom plan view of the FIG. **19** adjustable assembly.

FIG. **22** is a top plan view of the FIG. **19** adjustable assembly.

FIG. **23** is a side elevational cross-sectional view of the FIG. **19** adjustable assembly taken along line **23-23** in FIG. **22**.

FIG. **24** is a bottom perspective exploded assembly view of the FIG. **19** adjustable assembly.

FIG. **25** is an exploded assembly view of a third embodiment of an adjustable assembly.

FIG. **26** is a side elevational cross-sectional view of the FIG. **25** adjustable assembly.

FIG. **27** is a top perspective view of the FIG. **25** adjustable assembly with the outer member skewed at an angle relative to the main body.

FIG. **28** is a bottom perspective view of the FIG. **27** adjustable assembly.

FIG. **29** is a side elevational cross-sectional view of the FIG. **27** adjustable assembly.

FIG. **30** is a top perspective view of a fourth embodiment of an adjustable assembly.

FIG. **31** is a top plan view of the FIG. **30** adjustable assembly.

FIG. **32** is a side elevational cross-sectional view of the FIG. **30** adjustable assembly taken along line **32-32** of FIG. **31**.

FIG. **33** is a bottom perspective exploded assembly view of the FIG. **30** adjustable assembly.

FIG. **34** is a top perspective view of the FIG. **30** adjustable assembly with the outer member skewed at an angle relative to the main body.

FIG. **35** is a top elevational view of the FIG. **34** configuration.

FIG. **36** is a side elevational cross-sectional view of the FIG. **34** configuration taken along line **36-36** in FIG. **35**.

FIG. **37** is a top perspective view of a fifth embodiment of an adjustable assembly.

FIG. **38** is a side elevational cross-sectional view of the FIG. **37** adjustable assembly.

FIG. **39** is a bottom perspective exploded assembly view of the FIG. **37** adjustable assembly.

FIG. **40** is a side elevational cross-sectional view of the FIG. **37** adjustable assembly with the outer member skewed at an angle relative to the main body.

FIG. **41** is a bottom perspective exploded view of a light fixture assembly incorporating three of the FIG. **4** adjustable assemblies.

FIG. **42** is a bottom perspective view of a sixth embodiment of an adjustable assembly.

FIG. **43** is a side elevational cross-sectional view of the FIG. **42** adjustable assembly.

FIG. **44** is a bottom perspective view of the FIG. **42** adjustable assembly with the outer member skewed at an angle relative to the main body.

FIG. **45** is a side elevational cross-sectional view of the FIG. **44** adjustable assembly with the outer member skewed at an angle relative to the main body.

## DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to

the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Any such alterations and further modifications in the illustrated device, and any such further applications of the principles of the invention as illustrated herein are contemplated as would normally occur to one skilled in the art to which the invention relates.

One aspect of the adjustable luminaries disclosed in this application provide a heat sink geometry which fits within a minimal footprint while providing high adjustability in the luminaire, allowing the individual light outputs to be spaced closely next to each other.

Another aspect of the adjustable luminaries disclosed in this application provide an adjustable light that remains centered such that the amount of emitted light blocked by trim placed over the luminaire is not significantly altered by adjusting the angle that the light shines through the trim.

In the claims and the description of the figures presented in this application, relative positioning terms such as "top" "up," "down," "bottom," "above," "below" and "under" are used to describe the relative position of components and the orientation of elements. These terms are not intended to be limiting relative to a gravitational orientation. The adjustable luminaries disclosed herein are frequently used as ceiling light fixtures. The description and drawings are presented on this basis. However, the disclosed adjustable luminaries are useful in other installations, such as in a wall or floor (shining upwardly). Similarly, the disclosed adjustable luminaries could be used with a curved surface, such that the luminaire installation could be oriented at any possible angle relative to the earth's surface, such as in a spherical structure. Relative positioning terms should be understood only in reference to the relative position shown in the drawings and the position of various components relative to each other, not to a gravitational orientation. Similarly, relative positioning terms should not be interpreted as limiting the orientation of the disclosed and claimed adjustable luminaire when installed.

All figures included in this application are drawn to scale.

Referring to FIGS. **1-3**, light fixture **100** is illustrated including enclosure **110**, trim **120** and adjustable assembly **130**. Enclosure **110** and trim **120** are only disclosed in reference to light fixture **100** while alternative embodiments of adjustable assembly **130** are presented below. The disclosed alternative embodiments of adjustable assembly **130** are constructed and arranged to interface with enclosure **110** and trim **120** as described below for adjustable assembly **130**.

Enclosure **110** includes a top **114** and four walls **112** defining opening **116** at the bottom of enclosure **110**. Latches **117** and **118** are mounted on the interior of walls **112** in enclosure **110**. Enclosure **110** may be constructed and arranged to facilitate mounting to an external structure such as ceiling or wall studs, or a dropped ceiling. Enclosure **110** may be constructed and arranged to be fully recessed into a ceiling or wall structure such that trim **120**, when mounted to enclosure **110**, is substantially flush with a surface of the wall or ceiling in which light fixture **100** is mounted. This is illustrated in FIG. **3** that shows enclosure **110** mounted inside ceiling **98** with the bottom opening substantially flush with ceiling surface **99**.

Trim **120** includes plate **122** defining opening **124** and a plurality of catches **126** extending upwardly around the periphery of plate **122**. In the illustrated embodiment, opening **124** is generally square shaped. However it should be understood that any desired shape may be utilized including, but not limited to, a circular shape or any desired type of polygon.

Adjustable assembly **130** generally includes main body **140**, outer member **150**, inner member **160**, light assembly **170** and rod **196**. Adjustable assembly **130** is described below in detail in the description of FIGS. **4-18**.

Main body **140** of adjustable assembly **130** includes a plurality of catches **148** that project upward from flange **145**. Flange **145** also defines a plurality of holes **141**. Light fixture **100** is assembled by inserting adjustable assembly **130** through opening **116** in enclosure **110** with latches **117** engaging catches **148** thereby releasably securing adjustable assembly **130** to enclosure **110**. Trim **120** is attached by passing catches **126** through holes **141** in flange **145** on main body **140** and engaging latches **118** on catches **126** thereby releasably securing trim **120** to enclosure **110**.

Referring to FIGS. **4-8**, adjustable assembly **130** is shown in isolated detail. Adjustable assembly **130** generally includes main body **140**, outer member **150**, inner member **160**, light assembly **170** and rod **196**.

As best seen in FIGS. **9-10**, main body **140** includes flange **145**, curved portion **142**, with curved portion **142** defining inner surface **143** and outer surface **144**, and curved portion **142** also defining top opening **146** and bottom opening **147**. As described above, a plurality of catches **148** protrude upwardly from flange **145** with a plurality of holes **141** constructed to permit the passing of catches **126** on trim **120**. Outer surface **144** may have radius R**1** and inner surface **143** may have radius R**2**. Main body **140** defines bottom plane P**1** that substantially lies along the bottom surface of flange **145**. Curved portion **142** of main body **140** may define center point C that corresponds to the center of curved portion **142**. In the illustrated embodiment, center point C is positioned above bottom plane P**1** by approximately the thickness of flange **145**.

Also as shown in FIG. **18**, the direction of light emission V**1** may pass through center point C regardless of the relative position of light source **190** relative to main body **140**. In addition, no portion of light assembly **170**, including light source **190** and lens **192**, extends through bottom plane P**1**. Accordingly, light source **190** can be positioned anywhere allowed by the geometry of the various components of adjustable assembly **130** without interfering with or blocking use of trim **120** that may cover a portion of bottom opening **147** of main body **140**. This may also create a more pleasing and consistent presentation of light fixture **100** when installed. In addition, while center point C is positioned above trim **120** by approximately the thickness of flange **145** and trim **120**, this configuration may still result in emitted light being directed through an approximate middle of opening **124** in trim **120** and minimize emitted light being blocked by trim **120**, regardless of the relative position of light source **190** to main body **140**.

Curved portion **142** of main body **140** may approximate a hollow spherical segment and may have an arc angle A**1**. In the illustrated embodiment, arc angle AA is approximately 40 degrees. In alternative embodiments, arc angle AA may vary between approximately 35 degrees and approximately 45 degrees.

Flange **145** may extend away from curved portion **142** and bottom opening **147** from a hoop that approximates a great circle of the hollow spherical segment that may define curved portion **142**. As such, curved portion **142** may be oriented substantially normally to flange **145** where curved portion **142** meets flange **145**. In addition, together, curved

portion **142**, inner member **160** and intermediate member **186** may define a shape that approximates a hollow hemisphere.

As best seen in FIGS. **8** and **11**, outer member **150** defines a curved surface **152** having radius R**3** with center portion **154** extending downwardly from the center of curved surface **152**. Outer member **150** includes a plurality of fins **156** on its top with fins **156** extending upwardly and outwardly from curved surface **152**. Note that, in the illustrated embodiment, curved surface **152** is defined by fins **156** that are spaced apart from each other, such that curved surface **152** is not contiguous, but instead encompasses a plurality of fin segments that together define curved surface **152**.

Outer member **150** also defines slot **157** that is constructed and arranged to interact with rod **196** as described below. Outer member **150** also includes holes **158** that may be used for coupling outer member **150** to light assembly **170** as described below. Fins **156** define a conical profile **159** on the outer surface of outer member **150**. Curved surface **152** may approximate a segment of a hollow sphere and may define arc angle A**2** that extends away from center portion **154** to the outer edge of curved surface **152**.

As best illustrated in FIGS. **8** and **12**, inner member **160** is a curved planar member with outer surface **162** defining top opening **164** and inner surface **168** defining bottom opening **166**. Outer surface **162** has a radius R**4** and inner surface **168** has a radius R**5**. Inner member **160** approximates a hollow spherical segment and has an arc angle A**3**.

Referring now to FIG. **13**, intermediate member **186** is illustrated. Intermediate member **186** is a curved planar member with outer surface **188**, inner surface **189** and defines top opening **187**. Outer surface **188** has a radius R**6** and inner surface **189** has a radius R**7**. Intermediate member **186** may approximate a hollow spherical segment and may have an arc angle A**4**.

As best shown in FIG. **8**, light assembly **170** includes locking collar **172**, spring **178**, retaining cap **180**, light source **190**, lens **192** and retaining ring **194**. Locking collar **172** is a generally cylindrical body that defines opening **173** and includes levers **174**. Each lever **174** includes pivot point **175**, extension **176** and projection **177**. Retaining cap **180** has a generally cylindrical outer surface that includes groove **182** and holes **183**.

Adjustable assembly **130** is assembled with outer member **150** and retaining cap **180** coupled together with bolts **184** passing through holes **183** and secured in holes **158** on outer member **150** with intermediate member **186**, main body **140** and inner member **160**, locking collar **172** and spring **178** entrapped between outer member **150** and retaining cap **180**. Center portion **154** passes through top opening **178**, top opening **146**, top opening **164**, opening **173** and opening **179**. Light source **190** is mounted on retaining cap **180** with lens **192** positioned over light source **190** and secured in place by retaining ring **194**. Light source **190** is operatively coupled to outer member **150** through center portion **154** and the connection to retaining cap **180**. Inner member **160** is operatively coupled to outer member **150** as inner member **160** is forced to move angularly with outer member **150** because center portion **154** substantially fills top opening **164**.

Rod **196** is pivotally secured to brackets attached to flange **145** and passes through slot **157** on outer member **150**. Rod **196** generally interacts with outer member **150** to prevent substantial rotation of outer member **150** relative to main body **140**. Alternative embodiments may utilize other structures to perform the same rotation prevention function of rod **196**, including, but not limited to, a cable, wire, chain, etc.

Locking collar **172** is movable relative to retaining cap **180** through actuation of levers **174**. Projection **177** on lever **174** extends into groove **182** on retaining cap **180**. Levers **174** are held in position relative to locking collar **172** by pins located at pivot points **175** that permit rotation of levers **174** relative to locking collar **172**. Rotating extensions **176** away from the center of locking collar **172** in a radially outward direction moves projections **177** downward, thereby moving locking collar **172** upward relative to retaining cap **180**. As retaining cap **180** is secured directly to outer element **150** through center portion **154**, movement of locking collar **172** relative to retaining cap **180** moves locking collar **172** relative to outer element **150**.

Spring **178** is positioned between locking collar **172** and retaining cap **180** with center portion **154** passing through opening **179**. Spring **178** generally biases locking collar **172** upward and away from retaining cap **180**. Operation of levers **174** by rotating extensions **176** toward locking collar **172**, generally results in further compression of spring **178**.

Inner member **160**, main body **140** and intermediate member **186** are sandwiched between outer member **150** and locking collar **172**. In the configuration illustrated in FIG. **7**, this results in an abutting relationship between the members as illustrated that may result in sufficient friction between the contacting members to substantially prevent relevant movement absent an external force. In the illustrated configuration, internal surface **168** of inner member **160** abuts locking collar **172**. Outer surface **162** of inner member **160** abuts inner surface **143** of main body **140**. Outer surface **144** of main body **140** abuts inner surface **189** of intermediate member **186**. Outer surface **188** of intermediate member **186** abuts curved portion **152** of outer member **150**.

In the illustrated embodiment, light source **190** includes one or more light emitting diodes (LED) as are well known in the art. It should be understood that alternative light sources may be used including but not limited to incandescent lamps such as filament wires, halogen lamps, fluorescent lamps and gas discharge lamps. While not illustrated, electrical wiring for light source **190** may pass through retaining cap **180** and center portion **154** of outer member **150**. As described above, rod **196** generally prevents rotation of outer member **150** relative to main body **140**. This may advantageously reduce strain on wiring (not illustrated) for light source **190** by reducing twisting of light source **190** relative to wires passing through main body **140** that may be fixedly attached to an external power source for light source **190**. This may reduce incidence of wires inadvertently becoming severed or disconnected.

As best shown in FIG. **7**, light source **190** in combination with lens **192** has a direction of light emission V**1** that may correspond to a center of an arc of light emitted from lens **192**. In the embodiment illustrated in FIG. **7**, the direction of light emission V**1** substantially passes through center point C.

As shown in FIGS. **14-18**, the illustrated outer member **150** is selectively movable relative to main body **140** to alter the position of light source **190** relative to main body **140** and to alter the angular orientation of light source **190** relative to bottom plane P**1**. Relative movement of outer member **150** also moves the position and angular orientation of light source **190** and lens **192** relative to main body **140**. In the illustrated embodiment, this may be facilitated by actuating levers **174** to move locking collar **172** relative to retaining cap **180** to relieve the force exerted by locking collar **172** on inner member **160** to reduce the force pressing outer member **150**, main body **140**, inner member **160** and intermediate member **186** together. This reduces fictional

forces between outer member **150**, main body **140**, inner member **160** and intermediate member **186** and permits relative movement between inner member **160**, main body **140**, intermediate member **186** and outer member **150**. Outer member **150** may be moved relative to main body **140** to any position allowed by the interaction of center portion **154** residing in the geometry of top opening **146**. Abutment of center portion **154** against curved portion **142** defines the outer limit of movement permitted.

As shown in FIG. **18**, arc angles A**1**, A**2**, A**3** and A**4** may all be substantially equal. This configuration maximizes the contact area between outer member **150**, main body **140**, inner member **160** and intermediate member **186** while also maximizing the tilt angle AT of light source **190** and lens **192** relative to the top center position illustrated in FIG. **7**. In the illustrated embodiment, tilt angle AT is approximately 35 degrees (maximum). Note that in addition to rotating away from the top center position illustrated in FIG. **7**, outer member **150** and light source **190** can also be rotated around a complete 360 degrees, as viewed from above, to permit the orientation of light source **190** and the lens **192** to be moved in two directions.

In alternative embodiments, the relative arc angles of each component do not have to be substantially equal. For example, main body **140** arc angle A**1** may be between approximately 80 percent and approximately 120 percent of arc angle A**3** of inner member **160**.

Also as shown in FIG. **18**, conical profile **159** of outer member **150**, when positioned at a maximum tilt angle AT, may define a substantially vertical surface, as shown on the left side of FIG. **18**. Conical profile **159** may permit the positioning of outer member **150** at any position relative to main body **140** allowed by the geometry of the illustrated components while fitting within enclosure **110**. This geometry also lends itself to a narrow light fixture **100** that may permit multiple light fixtures **100** to be installed in close proximity with each other because extra width around the opening of light fixture **100** is not required to accommodate a wide heat sink structure.

Intermediate member **186** is optionally included to cover gaps or voids that may be present between outer member **150** and main body **140**, particularly when tilt angle AT is near its maximum. Such gaps or voids might otherwise be visible through bottom opening **147**. Inclusion of intermediate member **186** may provide a more consistent visible appearance for the inside of adjustable assembly **130** when viewed through bottom opening **147**, regardless of the relative position of light source **190**.

The relative position of outer member **150** relative to main body **140** may be subsequently re-secured by actuating levers **174** to reapply an abutting force between locking collar **172** and inner member **160**, thereby sandwiching inner member **160**, main body **140** and intermediate member **186** between outer member **150** and locking collar **172** and substantially securing the relative position of each member by friction between outer member **150**, main body **140**, inner member **160** and intermediate member **186**.

Referring to FIGS. **19-24**, a second embodiment of an adjustable assembly is shown in isolated detail as adjustable assembly **230**. Adjustable assembly **230** generally includes main body **240**, outer member **250**, inner member **160**, intermediate member **186**, light assembly **270** and rod **196**. Inner member **160**, intermediate member **186** and rod **196** are substantially the same as the components described above with regard to adjustable assembly **130**. Adjustable assembly **230** is interchangeable with adjustable assembly **130** for use in light fixture **100**. The description of other elements of light fixture **100** are not repeated for brevity.

Main body **240** is substantially the same as main body **140** except that main body **240** includes markings **249**. Markings **249** may optionally be included to provide a user visible feedback regarding an approximate tilt angle AT. While markings are only disclosed in some embodiments herein, it should be understood that markings can be optionally included in any of the disclosed adjustable assemblies. Main body **240** includes inner surface **243**, outer surface **244** and flange **245**.

As best seen in FIGS. **23** and **24**, outer member **250** defines a curved surface **252** with center portion **254** extending downwardly from the center of curved surface **252**. Center portion **254** includes external threads **255**. Outer member **250** includes a plurality of fins **256** on its top with fins **256** extending upwardly and outwardly from curved surface **252**. Note that curved surface **252** is defined by fins **256** and fins **256** are spaced apart from each other, such that curved surface **252** is not contiguous, but instead encompasses a plurality of fin segments that together define curved surface **252**.

Outer member **250** also defines slot **257** that is constructed and arranged to interact with rod **196** as described above to block substantial rotation of outer member **250** with respect to main body **140**. Outer member **250** also includes holes **258** that may be used for coupling outer member **250** to light source **290** as described below. Fins **256** define a conical profile **259** on the outer surface of outer member **250**. Curved surface **252** may approximate a segment of a hollow sphere.

As best shown in FIGS. **23** and **24**, light assembly **270** includes locking collar **272**, mounting plate **280**, light source **290**, lens **292** and retaining ring **294**. Locking collar **272** is a generally cylindrical body that defines internally threaded opening **273** having internal threads **274**.

Adjustable assembly **230** is assembled with outer member **250** and mounting plate **280** coupled together with bolts (not shown) with intermediate member **186**, main body **140** and inner member **160**, locking collar **272** entrapped between outer member **250** and mounting plate **280**. Center portion **254** passes through intermediate member **186**, main body **140** and inner member **160**. Light source **290** is mounted on mounting plate **280** with lens **292** positioned over light source **290** and secured in place by retaining ring **294**.

Rod **196** is pivotally secured to brackets attached to flange **145** and passes through slot **257** on outer member **250**. Rod **196** generally interacts with outer member **250** to prevent substantial rotation of outer member **250** relative to main body **140**.

Locking collar **272** is threadingly engaged with center portion **254** of outer member **250** and is movable relative to mounting plate **280** through threaded rotation of locking collar **272** relative to outer member **250**. Rotating locking collar **272** in a tightening direction moves locking collar **272** upward relative to mounting plate **280**. As mounting plate **280** is secured to outer element **250** through center portion **254**, movement of locking collar **272** relative to mounting plate **280** also moves locking collar **272** relative to outer element **250**.

Inner member **160**, main body **140** and intermediate member **186** are sandwiched between outer member **250** and locking collar **272**. In the configuration illustrated in FIG. **23**, internal surface **168** of inner member **160** abuts locking collar **272**. Outer surface **162** of inner member **160** abuts inner surface **143** of main body **140**. Outer surface **144** of main body **140** abuts inner surface **189** of intermediate

member **186**. Outer surface **188** of intermediate member **186** abuts curved portion **252** of outer member **250**. Sufficiently tightening locking collar **272** against inner member **160** may result in sufficient friction between the contacting members to substantially prevent relevant movement absent an external force. In addition, loosening locking collar **272** may permit relative movement between outer member **250**, inner member **160**, main body **140** and intermediate member **186** to allow the orientation of light source **290** and lens **292** to be repositioned relative to main body **140**.

In the illustrated embodiment, light source **290** includes one or more light emitting diodes (LED) as are well known in the art. It should be understood that alternative light sources may be used including but not limited to incandescent lamps such as filament wires, halogen lamps, fluorescent lamps and gas discharge lamps. While not illustrated, electrical wiring for light source **290** may pass through mounting plate **280** and center portion **254** of outer member **250**. As described above, rod **196** generally prevents rotation of outer member **250** relative to main body **140**. This may advantageously reduce strain on wiring (not illustrated) for light source **290** by reducing twisting of light source **290** relative to wires passing through main body **140** that may be fixedly attached to an external power source for light source **290**.

Referring now to FIGS. **25-29**, a third embodiment of an adjustable assembly is shown in isolated detail as adjustable assembly **330**. Adjustable assembly **330** generally includes main body **140**, outer member **350**, inner member **160**, intermediate member **186**, light assembly **370** and rod **196**. Main body **140**, inner member **160**, intermediate member **186** and rod **196** are substantially the same as the components described above with regard to adjustable assembly **130**. Adjustable assembly **330** is interchangeable with adjustable assembly **130** for use in light fixture **100**. The description of other elements of light fixture **100** are not repeated for brevity.

Similar to outer members **150** and **250**, outer member **350** defines a curved surface **352** with center portion **354** extending downwardly from the center of curved surface **352**. Outer member **350** includes a plurality of fins **356** on its top with fins **356** extending upwardly and outwardly from curved surface **352**. Note that curved surface **352** is defined by fins **356** and fins **356** are spaced apart from each other, such that curved surface **352** is not contiguous, but instead encompasses a plurality of fin segments that together define curved surface **352**.

Outer member **350** also defines slot **357** that is constructed and arranged to interact with rod **196** as described above to block substantial rotation of outer member **350** with respect to main body **140**. Fins **356** define a conical profile **359** on the outer surface of outer member **350**. Curved surface **352** may approximate a segment of a hollow sphere.

Light assembly **370** includes locking light housing **372**, spring **378** light source **390** and lens **392**. Light housing **372** is coupled directly to center portion **354** of outer housing. Light source **390** and lens **392** are coupled to light housing **372** with lens **392** oriented to project light emitted from light source **390**. Spring **378** is positioned around center portion **354** and abuts light housing **372** and inner member **160**.

Adjustable assembly **330** is assembled with outer member **350** and light housing **372** coupled together with intermediate member **186**, main body **140**, spring **378** and inner member **160**, entrapped between outer member **350** and light housing **372**. Center portion **354** passes through intermediate member **186**, main body **140** and inner member **160**.

Inner member **160**, main body **140** and intermediate member **186** are sandwiched between outer member **350** and light housing **372**. Inner member **160** abuts light housing **372** and main body **140**. Main body **140** also abuts intermediate member **186**. Intermediate member **186** also abuts curved portion **352** of outer member **350**. Spring **378** biases inner member **160**, main body **140**, intermediate member **186** and outer member **350** together to generate sufficient friction between the contacting members to substantially prevent movement of light source **390** relative to main body **140** absent an external force. However, these components may be configured such that the biasing force provided by spring **378** is not sufficient to prevent a human user from manually overcoming the friction between the components to manually reposition light source **390** relative to main body **140**.

In FIG. **29**, tilt angle AT is approximately maximum with light source **390** and lens **392** having a direction of emission V3 that is approximately centered on center point C.

Referring now to FIGS. **30-36**, a fourth embodiment of an adjustable assembly is shown in isolated detail as adjustable assembly **430**. Adjustable assembly **430** generally includes main body **440**, outer member **450**, inner member **460**, light **490** and lens **492**. Adjustable assembly **430** is interchangeable with adjustable assembly **130** for use in light fixture **100**. Main body **440** includes inner surface **443**, outer surface **444** and flange **445**.

Outer member **450** defines a curved inner surface **452** with center portion **454** downwardly from the center of curved inner surface **452**. Curved inner surface **452** may approximate a segment of a hollow sphere.

Adjustable assembly **430** is assembled with outer member **450** and inner member **460** coupled together by rivets **484** with main body **440** entrapped between outer member **450** and inner member **460**. Light source **490** is mounted directly to inner member **460** with lens **492** also mounted to inner member **460**.

Center portion **454** passes through main body **440**. Main body **440** is sandwiched between outer member **450** and inner member **460** with main body **440** abutting other outer member **450** and inner member **460** with sufficient force to generate sufficient friction between the contacting members to substantially prevent movement of inner member **460** relative to main body **440** absent an external force. However, these components may be configured such that the force is not sufficient to prevent a human user from manually overcoming the friction between the components to manually reposition inner member **460** and light source **490** relative to main body **440**.

In FIG. **36**, tilt angle AT is approximately maximum with light source **490** and lens **492** having a direction of emission V4 that is approximately centered on center point C.

Referring now to FIGS. **37-40**, a fifth embodiment of an adjustable assembly is shown in isolated detail as adjustable assembly **530**. Adjustable assembly **530** generally includes main body **540**, outer member **550**, inner member **560**, spring **578** and light assembly **570**. Adjustable assembly **530** is interchangeable with adjustable assembly **130** for use in light fixture **100**.

Light assembly **570** includes light housing **572**, light source **590** and lens **592**.

Main body **540** defines top opening **546** and includes inner surface **543**, outer surface **544** and flange **545**. Outer member **550** defines a curved inner surface **552** with center

portion **554** extending downwardly from the center of curved inner surface **552**. Curved inner surface **552** may approximate a segment of a hollow sphere.

Adjustable assembly **530** is assembled with outer member **550** and light housing **572** coupled together by rivets **584** with main body **540** and inner member **560** entrapped between outer member **550** and light housing **572**. Light source **590** is mounted directly to light housing **572** with lens **592** also mounted to light housing **572**.

Center portion **554** passes through main body **540** and inner body **560**. Main body **540** and inner body **560** are sandwiched between outer member **550** and light housing **572** with main body **540** abutting, outer member **550** and inner member **560** with sufficient force to generate sufficient friction between the contacting members to substantially prevent movement of light housing **572** relative to main body **540** absent an external force. However, these components may be configured such that the force is not sufficient to prevent a human user from manually overcoming the friction between the components to manual reposition light housing **572** and light source **590** relative to main body **540**.

In FIG. **40**, tilt angle AT is approximately maximum with light source **490** and lens **492** having a direction of emission V**5** that is approximately centered on center point C.

Referring to FIG. **41**, light fixture assembly **600** is illustrated. Light fixture assembly **600** incorporated a plurality of enclosures **110** and adjustable assemblies **130** together with a trim **620** that covers each of the enclosures **110** and adjustable assemblies **130**. In the illustrated embodiment, three sets of enclosures **110** and adjustable assemblies **130** are illustrated. However it should be understood that any number of enclosures **110** and adjustable assemblies **130** can be used together in any desired configuration. As illustrated, each enclosure **110** and adjustable assembly **130** may be positioned in close proximity to adjacent enclosures **110** and adjustable assemblies **130**. In the illustrated embodiment, the adjacent adjustable assemblies **130** and enclosures **110** abut. Note, while not illustrated, a unitary housing may be used in lieu of multiple enclosures **110**. Such a unitary housing would include space for multiple adjustable assemblies **130**.

Trim **620** includes a single plate **622** that defines multiple openings **624**, with each opening **624** positioned below an individual enclosure **110** and adjustable assembly **130**. Utilizing a single plate **622** may create a more visually pleasing appearance as plate **622** does not include additional breaks that would be required if multiple plates were utilized.

Referring to FIGS. **42-45**, a sixth embodiment of an adjustable assembly is shown in isolated detail as adjustable assembly **730**. Adjustable assembly **730** generally includes main body **140**, outer member **750**, inner member **160**, intermediate member **186**, locking collar **772** and light source **790**. Main body **140**, inner member **160** and intermediate member **186** are substantially the same as the components described above with regard to adjustable assembly **130**. Adjustable assembly **730** is interchangeable with adjustable assembly **130** for use in light fixture **100**. The description of other elements of light fixture **100** are not repeated for brevity.

As best seen in FIGS. **42** and **43**, outer member **750** defines a curved surface **752** with center portion **754** extending downwardly from the center of curved surface **752**. Center portion **754** includes external threads **755**. Outer member **750** includes a plurality of fins **756** on its top with fins **756** extending upwardly and outwardly from curved surface **752**. Note that curved surface **752** is defined by fins **756** and fins **756** are spaced apart from each other, such that curved surface **752** is not contiguous, but instead encompasses a plurality of fin segments that together define curved surface **752**. Fins **756** define a conical profile **759** on the outer surface of outer member **750**. Curved surface **752** may approximate a segment of a hollow sphere.

Locking collar **772** is a generally cylindrical body that defines internally threaded opening **774**. Locking collar **772** is threadingly engaged with center portion **754** of outer member **750** and is movable relative to outer member **750** through threaded rotation of locking collar **772** relative to outer member **750**. Rotating locking collar **772** in a tightening direction moves locking collar **772** upward relative to outer member **750**. Sufficiently tightening locking collar **772** against inner member **160** may result in sufficient friction between locking collar **772**, inner member **160**, main body **140**, outer member **750** and intermediate member **186** to substantially prevent relevant movement absent an external force. In addition, loosening locking collar **772** may permit relative movement between outer member **750**, inner member **160**, main body **140** and intermediate member **186** to allow the orientation of light source **790** to be repositioned relative to main body **140**.

Adjustable assembly **730** is assembled with intermediate member **186**, main body **140** and inner member **160** entrapped between outer member **750** and locking collar **772**. Center portion **754** passes through intermediate member **186**, main body **140** and inner member **160**. Light source **290** is mounted to outer member **750** and passes through center portion **754**.

In the illustrated embodiment, light source **790** is an incandescent lamp with an integrated lens. Various types of lamps can be used as light source **790**, such as filament wires, halogen lamps, fluorescent lamps and gas discharge lamps.

As shown in FIGS. **44-45**, the illustrated outer member **750** is selectively movable relative to main body **140** to alter the position of light source **790** relative to main body **140** and to alter the angular orientation of light source **790** relative to bottom plane P**1**. Relative movement of outer member **750** moves the position and angular orientation of light source **790** relative to main body **140**.

Light source **790** has a direction of light emission V**6** that may pass through center point C regardless of the relative position of light source **790** relative to main body **140**. In addition, no portion of light source **790** or locking collar **772**, extends through bottom plane P**1**. Accordingly, light source **790** can be positioned anywhere allowed by the geometry of the various components of adjustable assembly **730** without interfering with or blocking use of trim that may cover a portion of bottom opening **147** of main body **140**. While center point C is positioned above any attached trim by approximately the thickness of flange **145** and the trim, this configuration may still result in emitted light being directed through an approximate middle of an opening in the trim and may minimize emitted light being blocked by trim, regardless of the relative position of light source **790** to main body **140**.

Disclosed above are several structures that permit selective relative movement and angular reorientation of the light source relative to the light fixture, including structures that selectively urge abutting elements together and apart to allow relative movement as well as to secure abutting components from easily moving against each other. It should be understood that the disclosed structures are not limiting in that other structures may be utilized to achieve relative movement of different components. For example, an angled

surface could be actuated as a wedge against a biasing force to selectively move elements apart and bring them back together.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character. All changes and modifications that come within the spirit of the invention are desired to be protected.

I claim:

**1**. A light fixture comprising:

a hollow main body element that defines a shape that approximates a spherical segment with a central top opening and a bottom opening, wherein the bottom opening defines a bottom plane;

a lamp assembly comprising:

a light source;

an inner element;

an outer element, wherein the light source, the inner element and the outer element are operatively coupled together with the outer element positioned above the hollow main body element and the inner element positioned above the bottom plane with the hollow main body element positioned between the outer element and the inner element;

a central portion, carrying the light source, wherein the central portion extends through the central top opening of the hollow main body element and operatively couples the inner element to the outer element; and

a biasing element positioned below the inner element, wherein the biasing element forms an abutting relationship between the outer element, the hollow main body element, and the inner element, wherein the abutting relationship results in a frictional force that prevents movement between the outer element, the hollow main body element, and the inner element;

wherein the lamp assembly is constructed and arranged to be selectively movable according to a selective rotation of the outer element relative to the hollow main body element, wherein the selective rotation of the outer element is based on application of an external force on one or more elements of the lamp assembly that overcomes the frictional force caused by the abutting relationship, wherein moving the lamp assembly relative to the hollow main body element alters both a relative position of the lamp assembly relative to the hollow main body element and an angular orientation of the light source relative to the bottom opening and wherein the lamp assembly is constructed and arranged such that, regardless of the position of the lamp assembly relative to the hollow main body element, no portion of the lamp assembly extends below the bottom plane of the hollow main body element.

**2**. The light fixture of claim **1**, further comprising a peripheral flange that extends away from the bottom opening of the hollow main body element.

**3**. The light fixture of claim **2**, further comprising a light fixture housing that is constructed and arranged to be recess mounted in a wall or ceiling structure, wherein the light fixture housing is constructed and arranged to receive the hollow main body element with the peripheral flange positioned substantially flush with a surface of the wall or ceiling structure in which the light fixture housing is mounted.

**4**. The light fixture of claim **3**, further comprising a trim constructed and arranged to cover the housing and at least a portion of the peripheral flange.

**5**. The light fixture of claim **4**, wherein the light source has a direction of primary light emission, wherein the lamp assembly and the hollow main body element are constructed and arranged such that the direction of primary light emission passes through an approximate middle of the bottom of the hollow main body element regardless of the position of the light relative to the hollow main body element.

**6**. The light fixture of claim **2**, wherein the peripheral flange lies approximately along a great circle of the hollow spherical segment that defines the shape of the hollow main body element.

**7**. A light fixture comprising:

a hollow main body element that defines a shape that approximates a spherical segment with a central top opening and a bottom opening;

a lamp assembly comprising:

a light source;

an inner element;

an outer element, wherein the light source, the inner element and the outer element are operatively coupled together with the outer element positioned above the hollow main body element and the inner element positioned below the hollow main body element with the hollow main body element positioned between the outer element and the inner element;

a central portion, carrying the light source, wherein the central portion extends through the central top opening of the hollow main body element and operatively couples the inner element to the outer element; and

an actuation mechanism constructed and arranged to selectively move the position of the inner element relative to the outer element, wherein moving the inner element towards the outer element increases a frictional force that prevents movement between the outer element, the hollow main body element, and the inner element;

wherein the lamp assembly is constructed and arranged to be selectively movable according to relief of the frictional force caused by the actuation mechanism and selective rotation of the outer element relative to the hollow main body element, wherein the selective rotation of the outer element is based on application of an external force on one or more elements of the lamp assembly, wherein moving the lamp assembly relative to the hollow main body element alters an orientation of the light source relative to the bottom opening and wherein a position of the lamp assembly relative to the hollow main body element may be selectively secured by operation of the actuation mechanism.

**8**. The light fixture of claim **1**, wherein the biasing element comprises a locking collar that is threadingly engaged with the central portion such that the locking collar can be selectively moved relative to the hollow main body element by rotating it relative to the lamp assembly, wherein selective rotation of the locking collar reduces the frictional force that prevents movement between the outer element, the hollow main body element, and the inner element.

**9**. The light fixture of claim **7**, wherein the inner element, the outer element and the hollow main body element each have radial arc angles that are substantially equal.

**10**. The light fixture of claim **7**, wherein the outer element defines a concave shape that approximates a segment of a sphere.

**11**. The light fixture of claim **10**, further comprising an intermediate element that defines a shape that approximates a hollow spherical segment, wherein the intermediate element is positioned between the inner and outer elements of the lamp assembly and wherein the intermediate element is

constructed and arranged to cover any void between the hollow main body element and the outer element for any position of the lamp assembly relative to the hollow main body element.

**12**. The light fixture of claim **11**, wherein the outer element, the intermediate element and the hollow main body element all have radial arc angles that are substantially equal.

**13**. The light fixture of claim **12**, wherein the inner element defines a shape that approximates a portion of a sphere and wherein the inner element has a radial arc angle that is substantially equal to the radial arc angle of the hollow main body element.

**14**. A light fixture comprising:

a hollow main body element that defines a shape that approximates a spherical segment with a central top opening and a bottom opening;

a lamp assembly comprising:

a light source;

an inner element;

an outer element, wherein the light source, the inner element and the outer element are operatively coupled together with the outer element positioned above the hollow main body element and the inner element positioned below the hollow main body element with the hollow main body element positioned between the outer element and the inner element;

a central portion, carrying the light source, wherein the central portion extends through the central top opening of the hollow main body element and operatively couples the inner element to the outer element;

an intermediate element that defines a shape that approximates a hollow spherical segment, wherein the intermediate element is positioned between the inner and outer elements of the lamp assembly and wherein the intermediate element freely moves with respect to the lamp assembly; and

a locking collar positioned below the inner element, wherein the locking collar is engaged with the central portion such that the locking collar can be selectively moved relative to the inner element to form an abutting relationship between the outer element, the hollow main body element, the intermediate element, and the inner element, wherein the abutting relationship results in a frictional force that prevents movement between the outer element, the hollow main body element, the intermediate element, and the inner element;

wherein the lamp assembly is constructed and arranged to be selectively movable according to relief of the frictional force caused by the locking collar and a selective rotation of the outer element relative to the hollow main body element, wherein the selective rotation of the outer element is based on application of an external force on one or more elements of the lamp assembly, wherein moving the lamp assembly relative to the hollow main body element alters an orientation of the light source relative to the bottom opening.

**15**. The light fixture of claim **14**, wherein the inner element has a radial arc angle substantially equal to a radial arc angle of the hollow main body element.

**16**. The light fixture of claim **14**, wherein the locking collar comprises a releasable clamping mechanism constructed and arranged to selectively urge the inner element, the hollow main body element, the intermediate element and the outer element together.

**17**. A light fixture comprising:

a hollow main body element that defines a shape that approximates a spherical segment with a central top opening and a bottom opening;

a lamp assembly comprising:

a light source;

an inner element that defines a shape that approximates a portion of a sphere;

an outer element, wherein the light source, the inner element and the outer element are operatively coupled together with the outer element positioned above the hollow main body element and the inner element positioned below the hollow main body element with the hollow main body element positioned between the outer element and the inner element;

a central portion, carrying the light source, wherein the central portion extends through the central top opening of the hollow main body element and operatively couples the inner element to the outer element, wherein the arc angle of the hollow main body element is between approximately 35 degrees and 45 degrees; and

a biasing element positioned below the inner element, wherein the biasing element forms an abutting relationship between the outer element, the hollow main body element, and the inner element, wherein the abutting relationship results in a frictional force that prevents movement between the outer element, the hollow main body element, and the inner element;

wherein the lamp assembly is constructed and arranged to be selectively movable according to relief of the frictional force caused by the abutting relationship and a selective rotation of the outer element relative to the hollow main body element, wherein the selective rotation of the outer element is based on application of an external force on one or more elements of the lamp assembly that overcomes the frictional force caused by the abutting relationship, wherein moving the lamp assembly relative to the hollow main body element alters an orientation of the light source relative to the bottom opening.

**18**. The light fixture of claim **17**, wherein the arc angle of the hollow main body element is approximately 40 degrees.

**19**. The light fixture of claim **17**, wherein the hollow main body element has an arc angle between approximately 80 percent and approximately 120 percent of an arc angle of the inner element.

**20**. The light fixture of claim **7**, wherein the actuation mechanism comprises a locking collar that is engaged with the central portion, wherein the locking collar can be selectively moved relative to the hollow main body element through actuation of a plurality of levers coupled to the locking collar, wherein selective actuation of the plurality of levers reduces the frictional force that prevents movement between the outer element, the hollow main body element, and the inner element.

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